INSTRUCTION MANUAL

W/I AUTO TESTER

MODEL TOS8850

86.1.4

GENERAL ELECTRIC
INSTRUMENTATION & COMMUNICATION
1200 KONA DRIVE
COMPTON, CA 90220
(213) 537-0317

KIKUSUI ELECTRONICS CORPORATION

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CAUTION

THIS INSTRUMENT GENERATES AND DELIVERS A HAZARDOUSLY HIGH VOLTAGE (5 kV). BE EXTREMELY CAREFUL WHEN USING THIS INSTRUMENT. BE SURE TO READ SECTION 3 "PRECAUTIONS BEFORE USE" BEFORE USING THIS INSTRUMENT.

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On Power Supply Source, it is requested to replace the related places in the instruction manual with the following items.

(Please apply the item of √ mark)

☐ Power Supply Voltage: to .....VAC

☐ Line Fuse: to .....A

☐ Power Cable: to 3-core cable (See Fig. 1 for the colors)

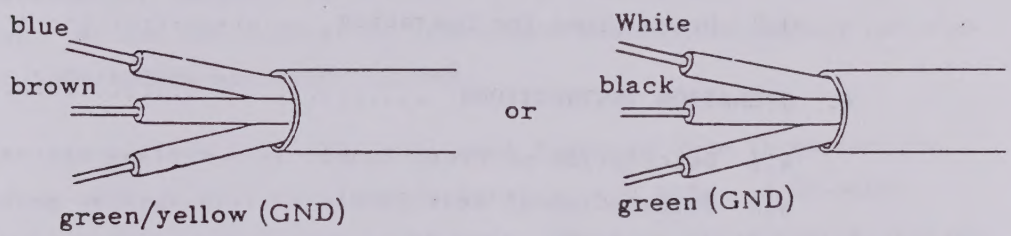

Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

* AC Plug : In case of the Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered, in view of the safety.

(AC Plug on 3-core cable is taken off in regardless of input voltages.)

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

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1. GECERAL

Model TOS8850 W/I Auto Tester is a combination of an withstanding voltage tester and an insulation resistance tester, and it is capable of performing withstanding voltage test and insulation resistance test in one continuous process.

As for the withstanding voltage tester, the Tester can provide a maximum output voltage of 5 kV and an output wattage of 500 VA, and can be used for withstanding voltage test in compliance with JIS, Electrical Appliance Control Ordinance, UL, CSA, BS and other major electrical standards and ordinances. As for the insulation resistance tester, the Tester has two ranges of 500V/1000MΩ and 1000V/2000MΩ.

The Tester can perform a GO-NOGO judgement function when in either the withstanding voltage or insulation resistance test mode. A GO-NOGO judgement is with a window comparator type. When in withstanding voltage test, the Tester is capable of generating an NG judgement not only when the detected leakage current is greater than the high limit reference value preset on the front panel of the Tester but also when it is less than the low limit reference value (which is continuously adjustable down to one-half of the high limit reference value), thereby contributing to make GO-NOGO judgement including test of open circuiting of leadwires and imperfect contacting of connections.

The Tester is incorporated with a function to deliver signals representing the result of GO-NOGO judgement and the state of the Tester, and a remote control function. The signals namely are TEST ON, GOOD, READY, and NG alarm (contact signals). The Tester is incorporated also with a remote control function for test set/reset. These features can be utilized for automatic test with lador economization.

The Tester, which employs a high voltage, is incorporated with a variety of features to protect the operator and the Tester itself. Its sequence circuit is designed with full attention to noise to prevent erroneous operation which could be caused by noise.

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2. SPECIFICATIONS

Withstanding Voltage Tester

Test Voltage

Applied voltage:	0 - 2.5 kV AC and 0 - 5 kV AC (two ranges)
Wattage rating:	500 VA (5 kV, 100 mA, with 100 V line voltage) (See Note 1.)
Waveform:	AC line waveform
Voltage regulation:	Better than 20% (for maximum rated load to no load, with 100 V line voltage)
Switching:	With zero-start type switch

Output Voltmeter

Scales:	2.5 kV FS and 5 kV FS, two ranges linear scales
Class of meter:	JIS Class 1
Accuracy:	±3% FS or better
Indication:	Mean-value response, effective-value scale graduation

Judgement of Test Result

(GO-NOGO judgement. Output cutoff by leakage current detection)

Judgement:	o Window comparator system o NG judgement when leakage current larger than high limit reference value is detected. o NG judgement also when leakage current smaller than low limit reference value is detected. o When NG judgement is made, output is cutoff and NG alarm is generated. o If no NG judgement is made after preset period has elapsed, GOOD signal is generated.
High limit reference value (CUTOFF CURRENT):	0.5/1/2/4/8/10/100 mA (7 values) By combinations of above values, a range of 0.5 - 25.5 mA can be covered in 0.5-mA steps.

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Low limit reference value (LOWER REFERENCE):	0 to one-half of high limit reference values (continuously variable)
Accuracy of judgement: (See Note 2.)	o ±5% of high limit reference value o ±20% of low limit reference value (one-half of high limit reference values at maximum counter-clockwise). (Others are non-calibrated.)
Judging method:	Absolute value of leakage current is integrated and compared with preset limit reference value
Calibration:	Calibrated with rms value of sine wave, using a pure resistance load
No-load output voltage needed for detection: (See Note 3.)	2.5 kV range: Approx. 450 V when set at 100 mA 5 kV range: Approx. 550 V when set at 100 mA

Others

Test time:	0.2 seconds - 10 minutes (with 4-range timer)
Terminals:	Terminals for monitoring of leakage current

Note 1: When the Tester is delivering its maximum rated current, its maximum rated continuous operation time is 30 minutes.

Note 2: The current which flows due to stray capacitances of the output circuit and leadwires causes an error. The overall accuracy of judgement is the above-mentioned accuracy of judgement plus a factor caused by this current. Typical values of this type of currents are shown in the below table. Note that, when a test is made with a high voltage and high sensitivity, the current which flows through the stray capacitances may become larger than the preset low limit reference value and low limit judgement may become unavailable.

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Output voltage	1 kV	2 kV	3 kV	4 kV	5 kV
Tester alone (without test leadwires)	4 μA	8 μA	12 μA	16 μA	20 μA
When 350-mm long lead-wires are hung in air	6 μA	12 μA	18 μA	24 μA	30 μA
When accessory lead-wires (HTL-1.5W) are used	20 μA	40 μA	60 μA	80 μA	100 μA

Note 3: When making an NG judgement test with the output terminals shorted, a certain level of no-load output voltage is needed due to the internal resistance of the output circuit. The voltages shown here are this type of output voltages.

Test Voltage Waveform: When an AC output voltage is applied to a capacitive load, it is possible that the voltage becomes higher than that when in the no-load state due to the capacitance of the load. Moreover, when the capacitance of the load is voltage dependent (typical examples are ceramic capacitors), the voltage waveform may be distorted. When the test voltage is 1.5 kV, however, effects caused by a capacitance of 1000 pF or less are negligible.

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Insulation Resistance Tester

Measuring Voltages:	500 V and 1000 V (two ranges), DC, negative polarity

Effective Measurange Ranges

500 V range:	1 - 1000 MΩ
1000 V range:	2 - 2000 MΩ

Values at Center of Scale

500 V range:	20 MΩ
1000 V range:	50 MΩ

Accuracy

1st effective measuring range:	±5% of the indicated value
2nd effective measuring range:	±10% of the indicated value

Note 4: At 25°C ±10°C

Note 5: The 1st effective measuring range is from 1/1000 to 1/2 of the maximum effective scale value. The 2nd effective measuring range is from the above to the maximum effective scale value.

Measuring terminal voltage

When output terminals are open:	+5%, -0% of rated measuring voltage
When at center of scale:	95% or more of rated measuring voltage

Judgement of Test Result (GO-NOGO judgement)

Judgement:

- o Window comparator system (mutually indepent settings of high limit and low limit)
- o NG judgement when measured resistance is smaller than the low limit reference value.

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- o NG judgement when measured resistance is larger than the high limit reference value.
- o When NG judgement is made, output is cutoff and NG alarm is generated.
- o If no NG judgement is made after preset period has elapsed, GOOD signal is generated.

Limit reference value setting range: Low and high limit reference values can be set at any points whthin the effective measuring range of the Tester.

Accuracy of judgement

1st effective measuring range: ±10% of set value

2nd effective measuring range: ±15% of set value

Note 6: at 25°C ±10°C

Waiting-time for judgement: Approx. 0.3 sec

Test Time: 0.5 seconds - 10 minutes (with 4-range timer)

Note 7: Since the Tester operates on an AC power line, measuring errors may be introduced if the device under test is connected to the AC line.

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Overall Specifications

Types of Tests

1. AUTO W → I: Withstanding voltage test first and insulation resistance test next
2. AUTO I → W: Insulation resistance test first and withstanding voltage test next
3. MANUAL W: Withstanding voltage test alone
4. MANUAL I: Insulation resistance test alone

Remote Control

Test/Reset control:

- o Low active control
- o Input conditions

High level input voltage:	11 - 15 V
Low level input voltage:	0 - 4 V
Low level sweep out current:	≦ 2 mA
Input pluse width :	20 msec minimum

Note 8: The input terminal is pulled up to +15V supply voltage by resistor. Opening of the input terminals is equivalent to a high level input.

Protection: Protection is effected when PROTECTION input terminal is made open (test is disabled).

Output Signals

TEST ON signal: Delivered during entire test-on period. Make-contact signal and lamp

GOOD signal: Delivered when GOOD judgement is made, for approximately 50 msec. Make-contact signal, lamp and buzzer

W/NG alarm: Delivered continuously when NG judgement of withstanding voltage test is made. Make-contact signal, lamp and buzzer

I/NG alarm: Delivered continuously when NG judgement of insulation resistance test is made. Make-contact signal, lamp and buzzer

READY signal: Delivered when in the READY state. Make-contact signal

Note 9: (1) The rating of the signal contacts is 100 V AC, 1 A, or 30 V DC, 1A.

(2) Loudness of the buzzer is adjustable with a knob in common for the GOOD signal and NG alarm.

Special Test Modes: Selectable with DIP switches at rear of the Tester

1. DOUBLE ACTION: Test starts only when the TEST button is pressed within approximately 0.5 seconds after pressing the RESET button.

2. GOOD HOLD: The GOOD state is held.

3. MOMENTARY: Test is executed only during the period the TEST button is kept pressed.

4. NG ALARM: NG alarm and PROTECTION state cannot be reset by the remote-control RESET signal.

Ambient Temperature and Humidity

Specification range: 5 to 35°C (41 to 95°F), 20 to 80% RH

Operable range: 0 to 40°C (32 to 104°F), 20 to 80% RH

Storage range: -20 to 70°C (-4 to 158°F), 80% RH or less

Power Requirements

Line voltage: 100 V ±10%, 50/60 Hz AC

Power consumption

When no load (RESET state): 15 VA or less

When with rated load: Approx. 600 VA

Insulation resistance: 30 MΩ or more, with 500 V DC

Withstanding voltage: 1000 V AC, 1 minute

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Dimensions:	430 W × 199 H × 370 D mm (16.93 W × 7.83 H × 14.57 D in.)
Including extrusions:	430 W × 214 H × 435 D mm (16.93 W × 8.43 H × 17.13 D in.)
Weight:	Approx. 24 kg (53 lb)
Accessories:	o HTL-1.5W High Voltage Test Leadwires, approx. 1.5 m (4.9 ft) long, 1 set o 5P DIN plug (assembly type), 1 o Power cord set, 1 o "CAUTION: HIGH VOLTAGE" seal, 1 o Instruction Manual, 1 copy
Options:	o Model 913A Remote Control Box o Model 914A Remote Control Box o HTP-1.5A High Voltage Test Probe, approx. 1.5 m (4.9 ft) long o HTP-3A High Voltage Probe, approx. 3 m (9.8 ft) long o HTL-3W High Voltage Test Leadwires, approx. 3 m (9.8 ft) long o Model 9202 Warning Light Unit o Model 9203 Buzzer Unit

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3. PRECAUTIONS BEFORE USE

3.1 Unpacking and Inspection

The Tester is shipped after being fully tested and inspected at the factory. Upon receiving the Tester, immediately unpack it and check for any signs of damage caused while in transportation. If any damage is found, immediately notify the bearer and/or the dealer.

3.2 Precautions for Operation

☐ The TOS8850 W/I Auto Tester has been designed with full attention to safety because this Tester handles a high voltage. Yet, as the Tester provides a high voltage as 5 kV to the external circuit, serious hazards are unavoidable unless the Tester is handled correctly. Be sure to observe the following when operating the Tester.

(1) Be sure to connect securely the GND terminal to a good grounding earth line. If grounding is imperfect, the Tester housing can be charged to the high voltage when the output is shorted to the ground line or power line and hazards can be caused to the operator when he touches the Tester.

(2) The connection method of the test leadwire of the GND side is shown in Fugure 3.1. Be sure to check for that this leadwire is not open, each time the Tester is used. Also be sure to connect at first the GND terminal to the ground line of the device under test. If it is not securely connected, the device under test becomes a floated state and a dangerously high voltage may be built up in the device under test.

(3) Be sure to wear rubber insulating gloves whenever operating this Tester, in order to guard against electric shock hazards.

(4) Before turning on the power switch, make it sure that the TEST VOLTAGE dial is in the fully counterclockwise position ("0" position).

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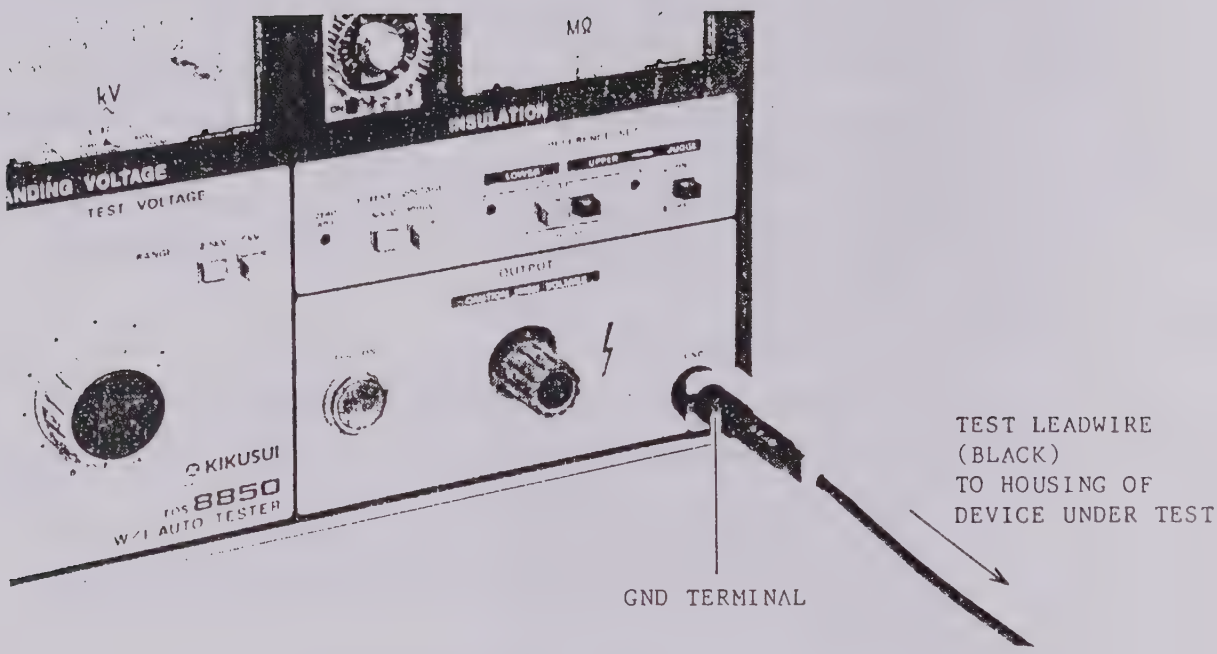

Figure 3.1

(5) Except when test is being done, turn the TEST VOLTAGE dial to the fully counterclockwise position ("0" position). Also, press the RESET (HV OFF) button for the sake of safety. Be sure to turn off the power switch each time the Tester is not used even for a short period of time or when the operator leaves the Tester.

(6) Before changing the voltage RANGE switch, make it sure that the Tester is in the RESET state and the TEST VOLTAGE dial is turned to the fully counterclockwise position ("0" position).

(7) Never touch the device under test, leadwires or the output terminals when the Tester is in the TEST ON state and the test voltage is being delivered.

Caution: The vinyl covers of the alligator clips of the accessory leadwires do not provide sufficient insulation. Never touch them when in the TEST ON state!

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(8) Before touching the divice under test, the test leadwires or output terminal, be sure to check the following:

(a) The output voltmeter indication is zero.

(b) The TEST ON lamp is off.

Also short the high voltage OUTPUT terminal to the GND terminal with the test leadwire of the GND terminal side.

(9) Do not short the output to the ground line or AC power line, lest the Tester housing should be charged up to a hazardously high voltage. It is permisseble, however, to short the high voltage OUTPUT terminal to the GND terminal when the Tester housing is grounded to an earth line.

(10) For a short period after a capacitive device under test is tested in the MANUAL I test mode (mamual insulation resistance test mode) or in the AUTO W → I mode (automatic mode with withstanding voltage test first and insulation resistance tset next), the device under test remains charged up to a high voltage. Never touch the device under test, test leadwires or terminals immediately after the test is over. Discharge periods for examples are as follows: When an equivalent circuit of the device under test is a 0.01-μF capacitor and a 100-MΩ resistor connected in parallel, the discharge period down to 30 V from test voltage 1000 V is approximately 3.5 seconds and that from test voltage 500 V is approximately 2.8 seconde. The period for discharge down to 30 V of other device under test can be estimated by referring to its time constant times the discharge periods of the device under test mentioned in the above examples.

(11) When the Tester is remote controlled, the high voltage output is turned on and off with an external signal. When operated in this mode, be extermely careful so that the high voltage output is not turned on inadvertently.

(12) In case of an emergency, immediately turn off the POWER switch and disconnect the AC power cord from the AC line receptacle.

(13) When in the TEST ON state, do not turn ON/OFF the POWER switch except in case of emergency. If this is done, maintaining of TEST ON/RESET/PROTECTION state is not guaranteed.

(14) If the TEST ON lamp goes on illuminating in spite of pressing RESET button or if the output voltmeter deflects in spite of that the TEST ON lamp is not illuminating, it is possible that the output voltage is delivered irrespective of test ON/OFF control. This type of failures are very dangerous. Immediately stop using the Tester and order your Kikusui agent for repair.

(15) When the TEST ON lamp has failed and does not turn on, immediately replace it or order your Kikusui agent for repair.

☐ To operate the Tester in good conditions for a long time, pay attention to the following:

(1) When in the no-load state, the maximum output voltage of the Tester becomes higher than 5 kV. An output voltage higher than 5 kV may be produced also when the AC line voltage has surged up. Operate the Tester with an output voltage not higher than 5 kV, whenever possible.

(2) The heat dissipation capacity of the high voltage transformer of this Tester is for one-half of the rated output, from the viewpoints of size, weight and costs. Therefore, continuous operation when set at the 100-mA CUTOFF CURRENT value must not exceed 30 minutes (at ambient temperature 40°C (104°F)). If more test time is required, pause the Tester for the same period that it has been used and then resume operation. This requirement does not apply when the CUTOFF CURRENT value is 25.5 mA or less.

(3) This Tester operates normally with an AC power line voltage range of 100 V ±10%. If the AC line voltage is not within this range, the Tester operation becomes unstable and damage may be caused to the Tester. When the AC line voltage in your area is not within this range, step it up or down into this range using an appropriate device.

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(4) Do not use or store the Tester in direct sunlight, high temperature or humidity, or dusty atmosphere.

☐ This Tester employs a high voltage output transformer of 500 VA. If the device under test draws a large currents, a large input current (several tens amperes) may flow for several tens milliseconds before the NG judgement is made and the output current is cutoff. (Same as just that moment of the TEST ON.)
Pay attention to the AC line capacity and to other instruments and devices connected to the same AC power line.

4. OPERATION INSTRUCTIONS

4.1 Description of Front Panel

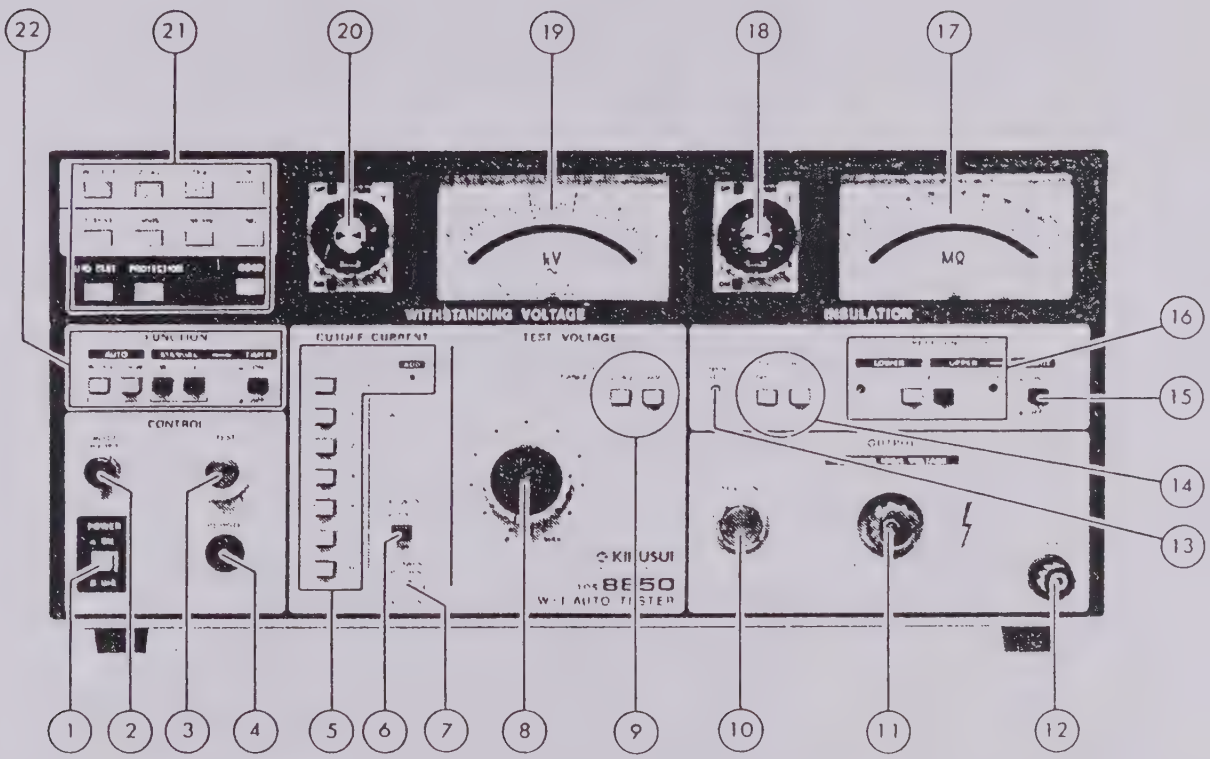

Figure 4.1

(1) POWER ON/OFF switch:

Main power switch of Tester. Before turning on the switch, be sure to read Section 3.2 "Precautions for Operation."

(2) RESET H.V OFF button:

To cutoff the H.V output when in test operation, press the button. The button is used also to reset from the NG alarm state or the PROTECTION state.

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③ TEST button:

As you press the button when the Tester is in the RESET state, the TEST ON lamp illuminates and the test as selected by the FUNCTION selector switch is performed by delivering to the output terminal the test voltage corresponding to the type of test selected.

④ REMOTE CONTROL connector:

When the TEST/RESET operation of the Tester is remotecontrolled, the connector is used to connect the control signal of the Remote Control Box (Model 913A or 914A) or other devices. Be sure to read Section 4.3.5 "Remote Control" (page 34) before remote-controlling the Tester.

⑤ CUTOFF CURRENT [mA] switches:

The switches select a high limit reference value (upper reference value) of leakage current for withstanding voltage test. The switch values are 0.5, 1, 2, 4, 8, 10 and 100 mA. By pressing one or more of these switches, values are selectable for a range of 0.5 – 25.5 mA in 0.5-mA steps. When two or more switches are pressed, the ADD lamp illuminates to indicate that the set current is the sum of those selected by two or more swithes. At the instant the leakage current of the device under test has exceeded the set high limit reference value, an NG judgement is made and the output is cutoff and an NG alarm is generated. Set the high limit reference value as you may require for the device under test.

⑥ LOWER ON/OFF switch:

The Tester is able to make an NG judgement also when the leakage current is less than the low limit reference value (LOWER REFERENCE value), as well as when the leakage current is more than the high limit reference value. The LOWER ON/OFF switch enables or disables this function.

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⑦ LOWER REFERENCE value control:

The potentiometer is used to set the low limit reference value for withstanding voltage test (LOWER REFERENCE value). The adjustable range is from zero to one-half of the high limit reference value set by the CUTOFF CURRENT switches. The fully clockwise position of the potentiometer is for one-half of the high limit reference value.

⑧ TEST VOLTAGE dial:

The dial controls the output voltage for withstanding voltage test. The output voltage increases as you turn this dial clockwise. Be sure to set the dial at the fully counterclockwise position (zero position) whenever no test is being done.

⑨ RANGE 2.5kV/5kV switches:

The switches select either the 2.5 kV or 5 kV range for withstanding voltage test. The switches are linked to the output voltmeter to change its ranges.

⑩ TEST ON lamp:

The lamp (red) indicates that the test voltage is ready to be delivered to the output terminal or that it is being delivered.

⑪ OUTPUT terminal:

The hot line of the test voltage.

⑫ GND terminal:

The ground line of the test voltage. Electrically, the line is connected to the Tester chassis.

⑬ ZERO ADJ control:

The potentiometer for electrical zero adjustment of insulation resistance meter.

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⑭ I TEST VOLTAGE 500V/1000V selector switches:

The switches select a test voltage for insulation resistance test.

⑮ JUDGE ON/OFF switch:

The switch selects whether the high-limit GO-NOGO judgement in the insulation resistance test is to be done or not.

⑯ REFERENCE SET switches:

The switches are for setting a GO-NOGO judgement reference value for insulation resistance test. When neither the UPPER switch nor the LOWER switch is pressed, the ohmmeter indicates the value of measuring resistance. When the LOWER switch is pressed, the ohmmeter indicates the low limit reference value for GO-NOGO judgement; when UPPER switch is pressed, the ohmmeter indicates the high limit reference value. When both switches are pressed, the LOWER switch has a priority. The limit reference values are adjustable with the potentiometers located at right and left of the switches.

⑰ Ohmmeter:

Indicates the resistance measured in insulation resistance test.

⑱ Timer:

Presets the insulation resistance test period. See Section 4.3.8 "Timer" (page 44).

⑲ Voltmeter:

Indicates the output voltage for withstanding voltage test. Directly measures the voltage of the high voltage output terminal.

(20) Timer:

Presets the withstanding voltage test period. See Section 4.3.8 "Timer" (page 44).

(21) Indicator lamps:

- o AUTO TEST: Identifies between automatic test and single test. The lamp illuminates when in the automatic test mode. When in the single test mode, either the W TEST lamp or the I TEST lamp illuminates.
- o W TEST: Illuminates when in the withstanding voltage test mode.
- o 2.5kV/5kV: Indicate the output voltage range being used for withstanding voltage test.
- o I TEST: Illuminates when in the insulation resistance test mode.
- o 500V/1000V: Indicate the test voltage being used for insulation resistance test.
- o GOOD/NG: Indicate the test result. If the result of GO-NOGO judgement is GOOD, the GOOD lamp illuminates; if it is NG, the NG lamp illuminates. The NG lamp illuminates continuously; the GOOD lamp illuminates only for about 50 msec. (NOTE) SPECIAL TEST MODES: GOOD HOLD OFF. When no timer is used in the single test mode, the GOOD judgement is not done.
- o PROTECTION: When in any of the following cases, the protective circuit trips, the output is cutoff and the lamp illuminates. (When this has occurred, remedy the cause of the trip and then press the RESET button to reset the Tester.)

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(1) When the RANGE 2.5kV/5kV switches of withstanding voltage tester are changed. When both switches are in the pushed-in state (▬ ▬) or pushed-out state (▮ ▮).

(2) When the I TEST VOLTAGE 500V/1000V switches are changed. When both switches are in the pushed-in state (▬ ▬) or pushed-out state (▮ ▮).

(3) When the FUNCTION switches are changed. When two or more switches are in the pushed-in state (▬ ▬ ▬ ▬) or all switches are in the pushed-out state (▮ ▮ ▮ ▮).

(4) When the REMOTE CONTROL connector is disconnected and then connected. (However, the lamp does not light when a connector which meets the requirements of reset condition is connected.) Without the NG ALARM of the SPECIAL TEST MODE switch ON state.

(5) When the remote protection input terminals are made open.

(6) When the POWER switch is turned on again immediately after turning it off.

(7) When all of the CUTOFF CURRENT switches are set in the pushed-out state or set at 108 mA or more.

(8) When both withstanding voltage tester and insulation resistance tester are operated at the same time due to a failure of the Tester.

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Note: If the lamp does not go off even when you have eliminated the cause of the trip to the PROTECTION state and have pressed the RESET button, the most probable cause is a failure of (8). Immediately stop using the Tester.

(22) FUNCTION selector switches:

When in the automatic test mode, the switches are used to set the order of withstanding voltage test and insulation resistance test. When in the single test mode, the switches are used to select either one of the two types of tests.

When in the automatic test mode, the test period is as preset by the timer. When in the single test mode, use or unuse of the timer is selectable by the TIMER ON/OFF switch located in the right hand side.

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4.2 Description of Rear Panel

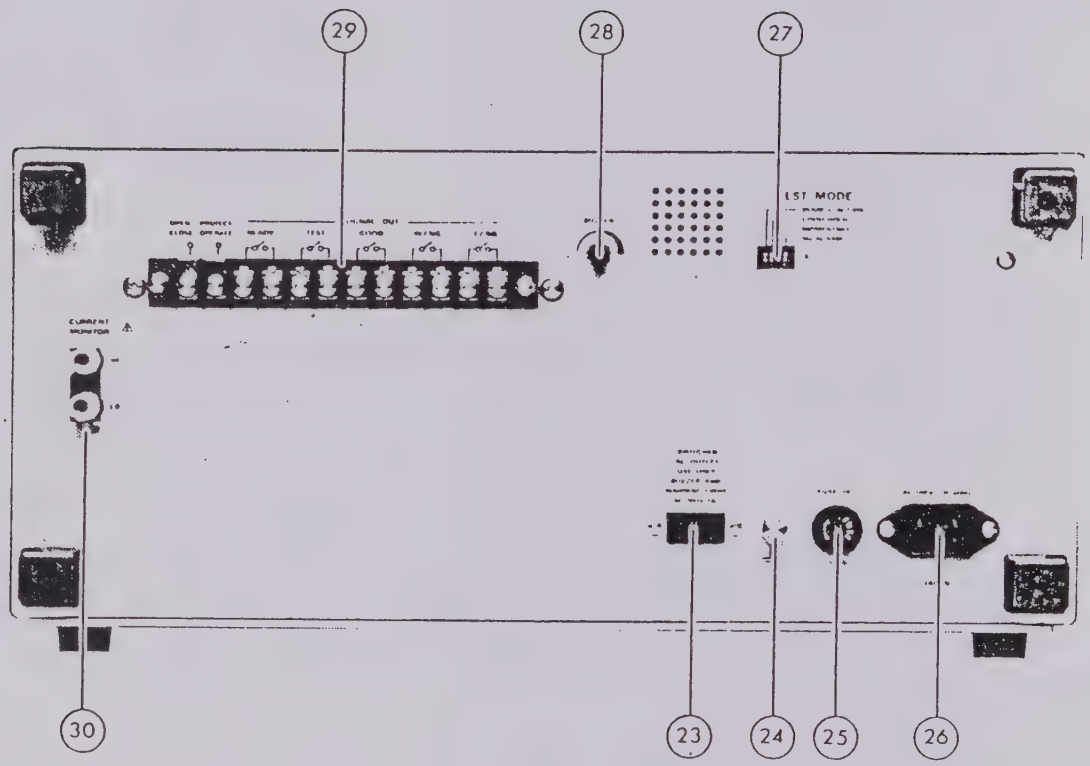

Figure 4.2

(23) SWITCHED AC OUTLET receptacle:

Delivers a 100 V AC power for Model 9202 Warning Light Unit or Model 9203 Buzzer Unit (both units are optional). The power is ON/OFF-controlled being linked to the POWER switch on the front panel. The receptacle is dedicated to the above optional units--do not use it for other purposes.

Note: The receptacle delivers the 100 V AC power even when the AC line voltage of the Tester is modified.

(24) GND terminal:

To ground the Tester to an earth line.

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(25) Fuse:

Fuse of the AC power line (7 amperes)

(26) AC 100V 50Hz/60Hz connector:

A 3P inlet for AC power line. Use the input power cord which accompanies the Tester.

(27) SPECIAL TEST MODE selector switches:

Select the DOUBLE ACTION, GOOD HOLD, MOMENTARY, or NG ALARM mode. Be sure to turn off the POWER switch before setting the selector switches. Refer to Section 4.3.7 "Special Test Modes" (page 42).

(28) BUZZER control:

Controls the loudness of buzzer of an NG or GOOD judgement

(29) Signal output and remote protection input terminal block

o SIGNAL OUT terminals:

For the READY, TEST ON, GOOD, W/NG, and I/NG output signals (contact signals). See Section 4.3.6 "Output Signals" (page 38).

o PROTECT/OPERATE terminals:

For REMOTE PROTECTION input signal. Normally the terminals are shorted with a shrting piece. When the terminals are made open, the TEST ON state is inhibited for protection.

(30) CURRENT MONITOR terminals:

The leakage current when in withstanding voltage test can be directly monitored by disconnecting the shorting bar from the terminals and connecting a milliammeter between them. The milliammeter should be capable of measuring the leakage current. Be sure to connect the shorting bar when the current is not monitored. A current may flow also when in insulation resistance test and this is not an abnormal indication.

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4.3 Operating Procedures

4.3.1 Procedure Before Test

(1) Before turning on the POWER switch, check that the voltmeter is indicating the "0" scale position and the ohmmeter is indicating the "∞" scale position. If the meters are not indicating these positions adjust them to these positions with their mechanical zero at their centers. If the Tester power is on, turn it off and then check the meters.

(2) Before turning on the POWER switch, thoroughly read and note the items of Section 3.2 "Precautions for Operation."

(3) When the PROTECTION indicator lamp is illuminating, test is disabled and cannot be started by pressing the TEST button. The conditions for illuminating of the lamp are given on Section 4.1 "Description of Front Panel" (pages 19 through 21). Eliminate the conditions and then press the RESET button to reset the Tester.

(4) When the POWER switch is turned on or off, the ohmmeter pointer may deflect irregulary. This is only transiential and is not an abnormal indication.

4.3.2 Single Withstanding Voltage Test

(1) Selecting the withstanding voltage test mode:

Select the MANUAL W TEST mode with the FUNCTION selector switches. The W TEST indicator lamp will illuminate.

(2) Selecting a test voltage range:

Select the required test voltage range (2.5 kV or 5 kV) with the RANGE 2.5 kV/5 kV switches. The corresponding indicator lamp will illuminate.

(3) Setting the high limit reference value of leakage current:

With the CUTOFF CURRENT switches, set the high limit reference value (upper reference value) of leakage current of the device under test as required.

8965-2

(4) Setting the test time:

Set the test time with the timer as requered by the device under test. Refer to Section 4.3.8 "Timer" (page 44).

(5) Setting the test voltage:

Set both TIMER ON/OFF switch and LOWER ON/OFF switch to the OFF state.

If the PROTECTION lamp is not illuminating, check that the TEST VOLTAGE dial is at fully counterclockwise position and press the TEST button. Adjust the test voltage by gradually turning clockwise the TEST VOLTAGE dial and reading the voltage on the voltmeter. Then, cutoff the output by pressing the RESET bytton. Next, set the TIMER ON/OFF switch to the ON state.

If the PROTECTION lamp is illuminating, press the RESET button once and then perform the above procedure.

(6) Connecting the device under test:

First of all, make sure that the output voltmeter indication is zero and the TEST ON lamp is not illuminating. Next, connect the GND test leadwire to the GND terminal of the Tester. With that test leadwire, short the high voltage output terminal to the GND terminal to make sure that no high voltage is being delivered to the output terminal. Then, connect the high voltage test leadwire (hot line) to the output terminal. Connect the GND leadwire to the device under test first and the high voltage test leadwire (hot line) to the device under test next.

(7) Test procedure:

(a) To start test, press the TEST button.

(b) When the period set by the timer has elapsed, the test voltage is cutoff and GOOD judgement is made and the GOOD signal is generated in the forms of lamp and buzzer and make-contact signal for about 50 msec.

(c) When a leakage current larger than the high limit reference value set by the CUTOFF CURRENT switches has flowed, the NG judgement is made and the output is instantaneously cutoff and the NG alarm with the lamp, buzzer and make-contact are generated. Different from the case of the GOOD signal, the NG alarm continue until the Tester is reset or the PROTECTION condition is effected. To reset from the NG state, press the RESET button.

(d) To abort the test being executed (to cutoff the output) for any reason, press the RESET button.

(8) Single test without using the timer

(a) The timer of the Tester is for 10 minutes maximum. When a test time longer than this is needed, perform the test without using the timer. However, note that, when the CUTOFF CURRENT switches are set for 100 mA or more, the continuous operation time rating of the Tester is up to 30 minutes. When the current setting is 25.5 mA or less, the Tester may be operated for a longer period.

(b) Set the TIMER ON/OFF switch to the OFF state.

(c) Connect the device under test to the output terminals of the Tester as described in Step (6).

(d) Check that the TEST VOLTAGE dial is set at the fully counter-clockwise position and then press the TEST button. The TEST ON lamp will illuminate to indicate that the test voltage is ready to be applied to the device under test. Gradually turn clockwise the TEST VOLTAGE dial until the necessary test voltage is obtained. When the required test time has elapsed or when a condition calling for aborting the test has occurred, press the RESET button to cutoff the output voltage. In this case the GOOD signal is not generated.

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(e) When an NG alarm is generated in the above test, operation is identical with that when the test is mode using the timer.

(9) Re-application of test voltage (retest):

If the Tester is in the RESET state, the test voltage as set by the TEST VOLTAGE dial can be delivered again to the output terminal simply by pressing the TEST button. If the Tester is generating an NG alarm or is in the PROTECTION state, press the RESET button to reset the Tester. If a GOOD judgement is made at the end of the test, the auto reset circuit operates and the Tester is automatically reset

(10) Setting the GO-NOGO judgement reference values for withstanding voltage test:

(a) The GO-NOGO judgement by the Tester is done in a window comparator system such that the GOOD judgement is made only when the measured leakage current is between the high and low limit reference values. The NG judgement can be made not only when the measured value is larger than the high limit reference value but also when it is smaller than the low limit reference value (0 to one-half of the high limit reference value).

The window comparator system is especially advantageous when the leakage currents of the device under test are predicted to be substantially ununifrom. To test such device under test, the high limit reference value may be set at a value slightly larger than the predicted highest value and the low limit reference value may be set at a value slightly smaller than the predicted lowest value, and the test may be done in the window comparator system. When this is done, device under test of exceptionally small leakage currents can be identified and open-circuiting of leadwires and imperfect contacting also can be detected, thereby substantially facilitating the withstanding voltage test.

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Tests with low limit judgements for low leakage currents will be inconvenient when setting the test voltage in the no-load state or when the device under test draw almost no current. In such cases, set the LOWER ON/OFF switch to the OFF state to disable the low limit judgement function.

(b) As mentioned in Note 2 (page 3), when test is made with a high sensitivity using a high AC voltage, it is possible that the current which folws through stray capacitances of the test leadwires and other device under test becomes larger than the low limit reference value and no low limit judgement for low leakage current can be correctly made. That is, when the device under test is disconnected from the test setup, an NG judgement should be made since the current drawn by the device under test is zero and is absolutely smaller than the low limit reference value. Actually, however, since the current which flows through the stray capacitances is larger than the low limit reference value, the Tester erroneously generates a GOOD judgement signal. Pay attention to this type of judgement errors. Prepare a test setup in a manner that the stray capacitances becomes minimum. Make it sure that the Tester correctly makes NG judgement when the device under test is disconnected from the test setup.

(c) To set the low limit reference value (LOWER REFFENT value), proceed as follows:

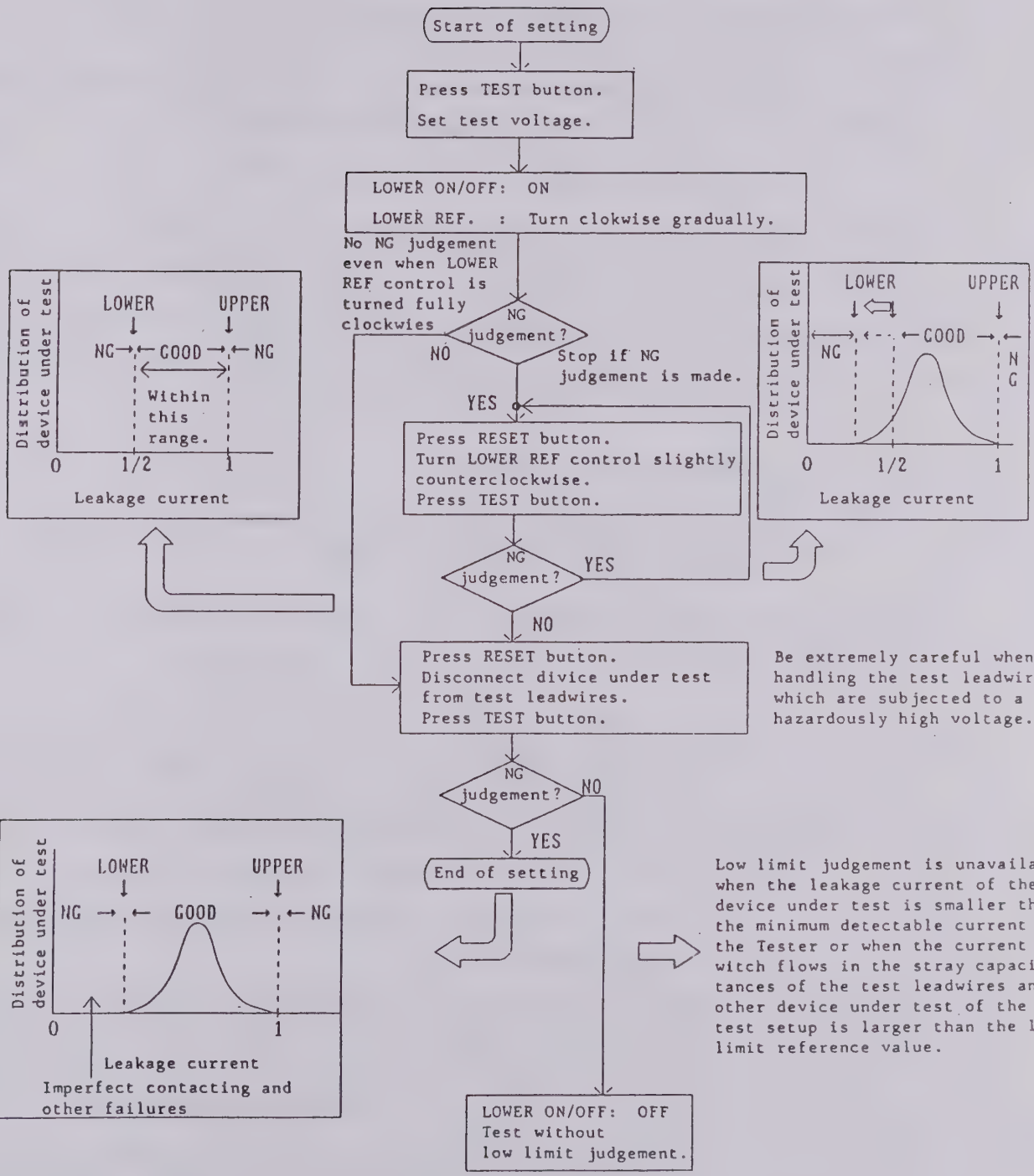
(i) Set the high limit reference value (CUTOFF CURRENT value). Set the TIMER ON/OFF switvh to the OFF state.

(ii) Set the LOWER ON/OFF switch in the OFF state. Turn the LOWER REFERENCE value control to the counter-clockwise position.

(iii) Connect the device under test as described in Step (6).

(iv) Make settings as shown in the flowchart on the next page.

865825



Note 1: For leakage current, the value set by the CUTOFF CURRENT switches is assumed to be the reference (value 1).

Note 2: UPPER: High limit reference value of leakage current for withstanding voltage test
LOWER: Low limit reference value of leakage current for withstanding voltage test

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4.3.3 Single Insulation Resistance Test

(1) Selecting the insulation resistance test mode:

Select the MANUAL I TEST mode with the FUNCTION selector switches. The I TEST indicator lamp will illuminate.

(2) Zero-ohm adjustment:

Check that the TIMER ON/OFF switch is in the OFF state. With the high voltage OUTPUT terminal shorted to the GND terminal, press the RESET button and then the TEST button. The ohmmeter will indicate approximately zero ohms. Precisely adjust the ohmmeter to zero ohms with the ZERO ADJ control potentiometer.

(3) Selecting a test voltage:

Select the required test voltage (500 V or 1000 V) with the I TEST VOLTAGE 500V/1000V selector switches.

(4) Setting the GO-NOGO judgement reference values for Insulation resistance test:

(a) The GO-NOGO judgement by the Tester is done in a window comparator system such that the GOOD judgement is made only when the measured insulation resistance is between the high and low limit reference values. The NG judgement is made not only when the measured value is lower than the low limit reference value but also when it is higher than the high limit reference value.

The window comparator system is especially advantageous when the insulation resistances of the device under test are predicted to be substantially ununiform. To test such device under test, the high limit reference value may be set at a value slightly higher than the predicted highest value of the device under test and the test may be made in the window comparator system. When this is done, device under test of exceptionally high insulation resistances can be identified and open-curcuiting of leadwires and imperfect contacting also can be detected, thereby attaining still better insulation resistance test.

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(b) With the REFERENCE SET switches set in the regular state (pushed-out state

), the ohmmeter indicates the measured resistance when in the insulation resistance test. When not in the insulation resistance test, the ohmmeter indicates the ∞ position.

(c) Press the LOWER REFERENCE SET switch, and the ohmmeter will indicate the low limit reference value. Next, press the UPPER REFFERENCE SET switch, and the ohmmeter will indicate the high limit reference valude. When the two switches are pressed at the same time, the LOWER REFERENCE SET switch has a priority.

(d) The high and low limit reference values can be set with the potentiometers located at right and left of the switches. Set the values as required by the device under test.

(e) For some types of tests, it may be undesirable to perform high limit judgement. In such cases, set the UPPER ON/OFF switch in the OFF state.

When the low limit judgement is not required, turn the low limit reference value setting potentiometer so that the ohmmeter pointer for the low limit reference value indicates a position lower than the zero ohm scale position.

(5) Setting the test time:

Set the TIMER ON/OFF switch to the ON state. Set the test time as required by the device under test (within a range of 0.5 seconds to 10 minutes with the timer). Refer to Section 4.3.8 "Timer" (page 44).

(6) Connecting the device under test:

Connect the device under test to the Tester in the same manner as in the case of withstanding voltage test.

(7) Test procedure:

(a) If the PROTECTION indicator lamp is illuminating, press the RESET button to reset the Tester. If the Tester is already in the RESET state, test can be immediately started simply by pressing the TEST button.

(b) If the device under test satisfies the conditions of GOOD judgement set for GO-NOGO judgement in Step (4), the ohmmeter will indicates the measured resistance value. When the preset time has elapsed, the test voltage is cutoff, the divice under test is judged to be good, and the Tester will generate GOOD signals with the lamp, buzzer and make-contact for approximately 50 msec.

(c) If the device under test does not meet the above-mentioned test conditions, the NG judgement is made and the output is instantaneously cutoff and the NG alarm is generated. The alarm is with the lamp and make-contact which are different from those for the withstanding voltage test and with the buzzer which is used in common for the withstanding voltage test. To reset the alarm, press the RESET button.

(8) Test without using the timer:

Set the TIMER ON/OFF switch to the OFF stage. When this is done, insulation resistance test can be done irrespective of the timer as is the case for withstanding voltage test. If the Tester is in the RESET state, the test will start as you press the TEST button. As you press the RESET button, the output voltage is cutoff and the test ends.

(9) Re-application of test voltage (retest):

The re-application method of the test voltage is the same as that of the case of the withstanding voltage test.

4.3.4 Automatic Test

(1) Selecting a test sequence

The Tester is capable of performing a withstanding voltage test and an insulation resistance test sequentially. Sequence is selectable for "W → I" or "I → W" with the FUNCTION switches. When the Tester is set for this mode, the AUTO lamp illuminates. (Letter "W" stands for withstanding voltage test and letter "I" for insulation resistance tests.)

(2) Setting the test conditions:

Set the test voltages of withstanding voltage test or insulation resistance test, leakage current detection reference values, test time, and insulation resistance judgement reference values as in the case for the single-item tests.

(3) Connectinge the device under test:

Connect the device under test to the output terminal of the Tester as in the case for the single-item tests.

(4) Test procedure:

(a) Set the Tester in the RESET state and then press the TEST button. The Tester will automatically perform the two types of tests.

(b) When the test is over without the NG judgement, the GOOD signals are generated at the end of the test. The signals are the same with those of the single test.

When the withstanding voltage test or insulation resistance test is over with NG judgement, the output voltage is instantaneously cutoff the NG alarm is generated, and the test is end. The signals are the same with those of the single test.

(5) To abort the test:

To abort the test being performed, press the RESET button. The output voltage will be instantaneously cutoff and the Tester will be RESET state.

(6) Re-application of test voltage (retest):

When the test is over with the GOOD judgement, the Tester generates the GOOD signals for approximately 50 msec and then resets itself. The next test can be started simply by pressing the TEST button. When the Tester has generated the NG alarms, reset once the Tester and then press the TEST button.

4.3.5 Remote Control

(1) The TEST/RESET operation of the Tester can be remote-controlled with the remote control box (optional). As the plug of the remote control cable is connected to the REMOTE CONTROL connector on the Tester front panel, the internal circuit is automatically switched to the remote operation mode. In this case, the TEST button on the Tester front panel is disabled, although the reset operation can be done either at the Tester front panel or at the remote control box.

The Tester can be remote-controlled by other control system equipment without using the remote control box. This method is explained below.
Be extremely careful when using this method because the high voltage is on-off controlled with an external signal. Pay attention so that the high test voltage is not generated inadvertently. Also, provide full measures to ensure that the operator's body is not contacted with the output terminal or the test leadwires when the test voltage is being delivered. When these measures are unavailable, do not use the following remote control method.

(a) By controlling the TEST and RESET contacts shown in Figure 4.3, the test voltage can be on-off controlled in the same manner as done at the Tester front panel. (Special Test mode: NG ALARM OFF)

(b) In the case of the setup shown in Figure 4.4, the test voltage is turned on when the switch is thrown to the NO position, and Tester is forcefully reset when the switch is returned to the NC position. (Special Test mode: NG ALARM OFF)

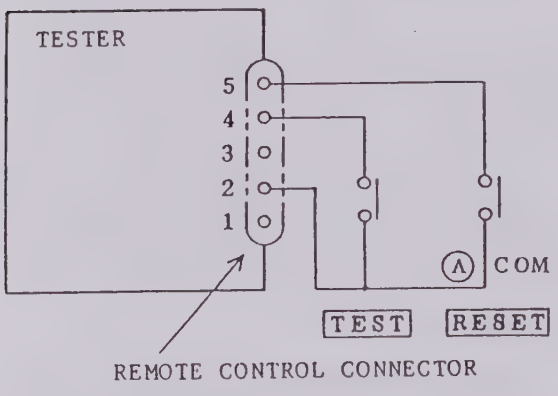


Figure 4.3

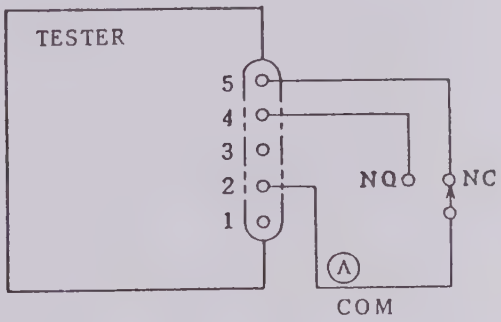


Figure 4.4

(c) Logical elements, transistors, FET's, or photocuplers may be used instead of the switches in Figure 4.3.
The example is shown in Figure 4.5. The input conditions of the Tester for such operation are as follows:

- o High level input voltage: 11 - 15 V
- o Low level input voltage: 0 - 5 V
- o Low level sweep out current: ≤ 2mA
- o Input pluse width: 20 msec minimum

Notes: 1. The gates are pulled up to +15 V. Opening of the input terminals is equivalent to a high level input.

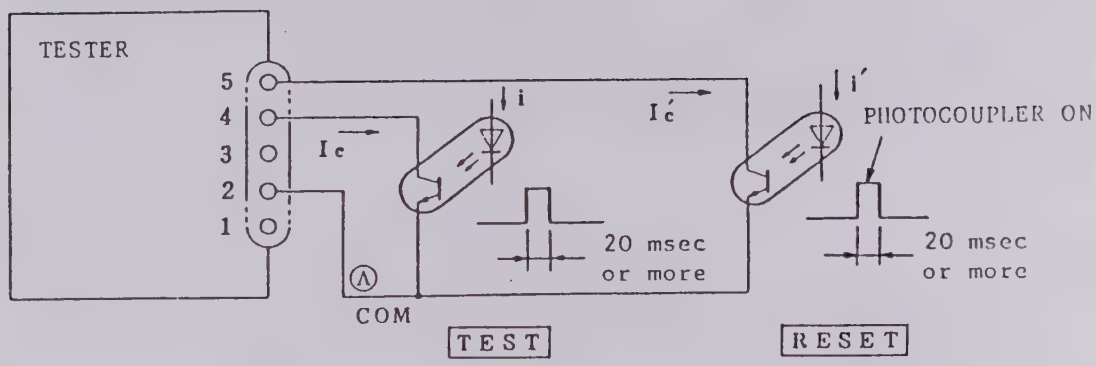


Figure 4.5

2. Currents i and i' must be sufficient to provide currents Ic and Ic' of 2 mA or more.

3. When using the CURRENT MONITOR terminals, isolate the common line (line Ⓐ in figure 4.5) of the control circuit from the power line and ground line of the Tester.

(d) With a view to prevent erroneous operation which could be caused by noise, it is recommendable to use photocouplers as shown in Figure 4.5 or relays as shown in Figure 4.3. The Tester is designed with full attention so that it does not erroneously operate by noise. Pay attention so that the devices connected to the tester do not erroneously operate by noise.

(e) Note that the layout of pins of the REMOTE CONTROL connector is as per DIN standard and is not in the due order of number progression, as shown in Figure 4.6.

Layout of connector pins as viewed from panel surface

Figure 4.6

(2) The Tester can be remote-controlled for PROTECTION state with an external signal through the PROTECT/OPERATE input terminals on the rear panel. If the Tester is in the PROTECTION state, on test voltage is delivered even when a test input signal is applied (or the TEST button is pressed) thereby maintaining the protected state. With this feature, erroneous delivery of the output voltage by an erroneous external condition can be eliminated to protect the operator.

An example of setup for the remote PROTECT/OPERATE control function is shown in Figure 4.7. When the contact shown in Figure 4.7 is open, the Tester is in the PROTECTION state. When the contact is closed and a reset signal is applied (or the RESET button is pressed), the Tester is reset to the state that it is ready to perform the test. When the Tester is shipped, the PROTECT/OPERATE input terminals are shorted with a shorting piece.

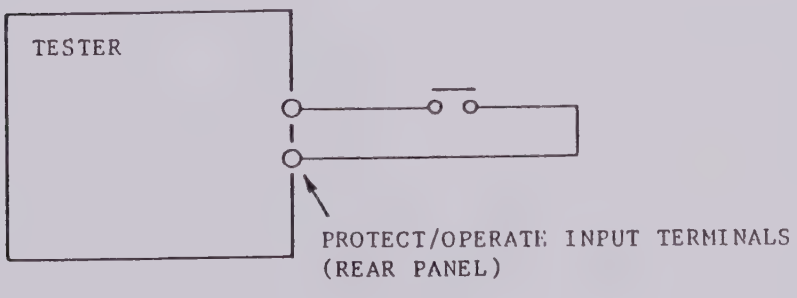


Figure 4.7

4.3.6 Output Signals

(1) The Tester delivers the following signals other than the lamp and buzzer signals.

No.	Signal	Condition for Delivery	Type and Rating
①	TEST ON	Entire period during test is on	Make-contact signal Ratings: 100 V AC, 1 A 30 V DC, 1 A
②	GOOD	When test is over. Approx. 50 msec	
③	W/NG	When NG judgement is made for withstanding voltage test. Continuous	
④	I/NG	When NG judgement is made for insulation resistance test. Continuous	
⑤	READY	When in ready for test	

① TEST ON signal: This signal is generated and remains on for the entire period of either the single test or the automatic test.

② GOOD signal: This signal is generated when a GOOD judgement is made at the end of a single test with the timer or at the end of the latter one of automatic tests. The signal lasts for approximately 50 msec.

③ W/NG alarm: This signal is generated when an NG judgement is made for the withstanding voltage test. This signal remains on until the next reset signal is applied (or the RESET button is pressed) or the PROTECTION signal is applied.

④ I/NG alarm: This signal is generated when an NG judgement is made for the insulation resistance test. The conditions for resetting the signal are the same as above.

⑤ READY signal: This signal is continuously delivered when the Tester is in the READY state (the state that the Tester is ready to be driven into the TEST ON state). That is, this signal is delivered when power of the Tester is turned on but a RESET signal is not applied (or the RESET button is not pressed), not in the TEST ON state, not generating the GOOD signal or NG alarm, and is not in the PROTECTION state.

As the TEST signal is applied (or the TEST button is pressed) when the READY signal is being delivered, the Tester starts the test operation.

(2) Contact signals

① The contact signals are only with contacts and without any power sources as Figure 4.8. Therefore, cannot drive any loads wihich have no power.

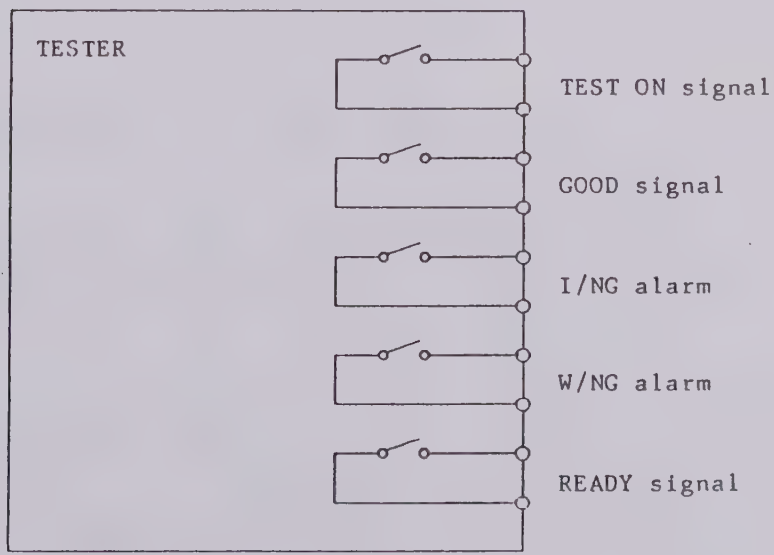


Figure 4.8

A contact which is closed when the signal is applied is called make contact, normally open contact, or form "a" contact. A contact which opens when the signal is applied is called break contact, normally closed contact, or form "b" contact.

The contacts of the Tester are of the make-contact type and their rating is 100 V AC, 1 A or 30 V DC, 1 A.
The withstanding voltage is 1500 V AC 1 minute between the circuit and shassis.

(2) Examples of use of these contacts are illustrated in the following.

(a) To drive a DC buzzer with an W/NG or I/NG alarms.

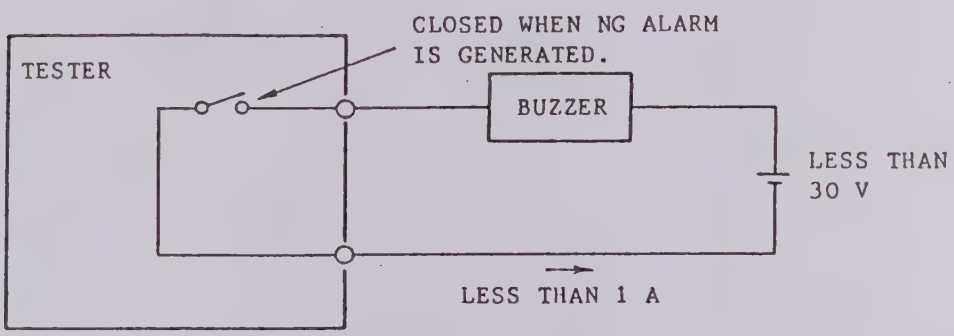


Figure 4.9

(b) To drive a lamp with the TEST ON signal;

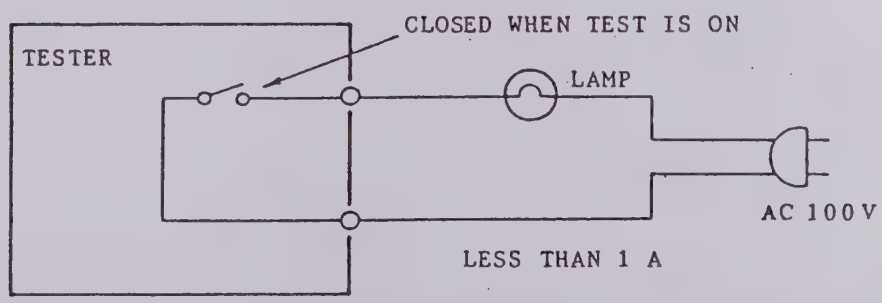


Figure 4.10

(c) To obtain an "L" level digital signal with the contact signal:

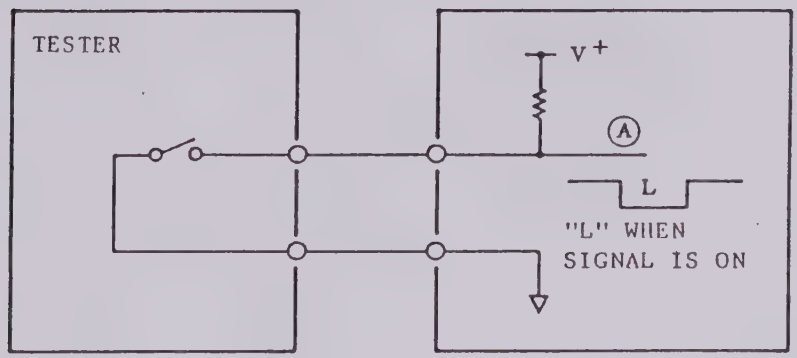


Figure 4.11

In the above illustration, an "L" level signal is obtained at point (A) when the contact output signal is on. However, since the signal obtained at point (A) include chattering, an appropriate chattering suppression provision should be incorporated depending on the nature of the circuit to be driven by this signal. In some cases, a noise suppression provision may be necessary.

4.3.7 Special Test Modes

TEST MODE

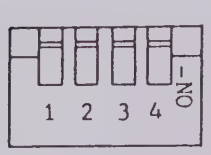


Figure 4.12

Four types of special modes are selectable with the TEST MODE selector switches on the rear panel. The standard positions of the switches (the positions as the switches are set as the Tester is shipped) are the OFF positions as shown in Figure 4.12. By throwing the switches to the ON positions, respective modes as described below can be selected. Since mode settings are mutually independent, any combinations of switch settings are possible.

(1) DOUBLE ACTION

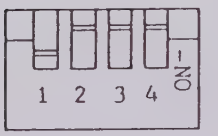


Figure 4.13

For the DOUBLE ACTION mode, set the switches as shown in Figure 4.13. When in the RESET state in the standard mode, as you press the TEST button, the Tester is driven into the TEST ON state. When in the DOUBLE ACTION mode, the Tester is driven into the TEST ON state provided that you press the TEST button within approximately 0.5 seconds after pressing the RESET button. That is, no test is started unless both RESET and TEST buttons are pressed in the correct sequence within a certain period. While the procedure is more complicated due to the double switch actions, a higher safety of test can be attained.

The function is the same as above also when in the remote control mode.

(2) GOOD HOLD:

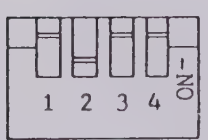


Figure 4.14

For the GOOD HOLD mode, set the switches as shown in Figure 4.14. When a GOOD judgement is made in the standard mode, the Tester generates a GOOD signal only for approximately 50 msec. When in the GOOD HOLD mode, the GOOD signal is continuously held until the RESET signal is applied.

(3) MOMENTARY

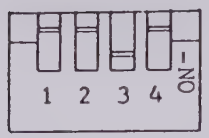


Figure 4.15

For the MOMENTARY mode, set the switches as shown in Figure 4.15. When in the standard mode, once the TEST button is pressed, the TEST ON state is maintained until the period set by the timer elapses or the RESET button is pressed. When in the MOMENTARY mode, the TEST ON state is maintained only for the period the TEST button is kept pressed. As you release the TEST button, the test stops instantaneously. Thus, the MOMENTARY mode is advantageous from the viewpoint of operation safety.

Still higher operation safety can be attained by operating the Tester in the MOMENTARY mode and using Model 914A Remote Control Box (both-hand type, option) in conjunction.

When test is made with the timer, the Tester generates a GOOD signal for approximately 50 msec after the test for the period preset by the timer has elapsed, and then the test ends.

(4) NG ALARM

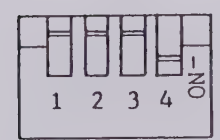


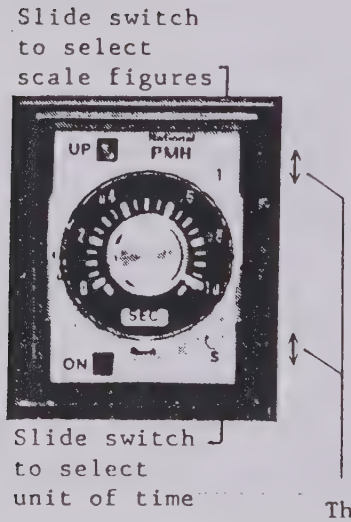
Figure 4.16

For the NG ALARM mode, set the switches as shown in Figure 4.16. When the Tester is set in the standard mode, as a remote RESET signal is applied, the test voltage is cutoff and the NG alarm and PROTECTION state and GOOD signal are reset as in the case that the RESET button on the front panel is pressed. When in the NG ALARM mode, as a remote RESET signal is applied, although the output is cutoff and the GOOD signal is reset, the NG alarm and the PROTECTION state are not reset. To reset the NG alarm and PROTECTION state, press the RESET button on the front panel.

This mode provides an effective means for confirming the NG alarm when Model HTP-1.5A or HTP-3A High Voltage Probe (optional) is used.

4.3.8 Timer

The timer has two slide switches to select four time ranges. The units of time and figures on the scale plate also are changed as the switches are changed, allowing you to directly read the set time range.



Settings of slide switches				
Setting range	0.05S～1.0S	0.5S～10S	0.05M～1.0M	0.5M～10M

S: Second M: Minute

Throw the slide switches to the top or bottom positions.

Figure 4.17 Timer and Slide Switches

Note 1: When the low limit judgement is used for withstanding voltage test, be sure to set the timer for 0.2 seconds or a longer period.

Note 2: For insulation resistance test, be sure to set the timer for 0.5 seconds or a longer period. Refer to Section 5.4 "Waiting-time for Judgement in Insulation Resistance Test." (page 49)

5. OPERATING PRINCIPLE

5.1 Block Diagram

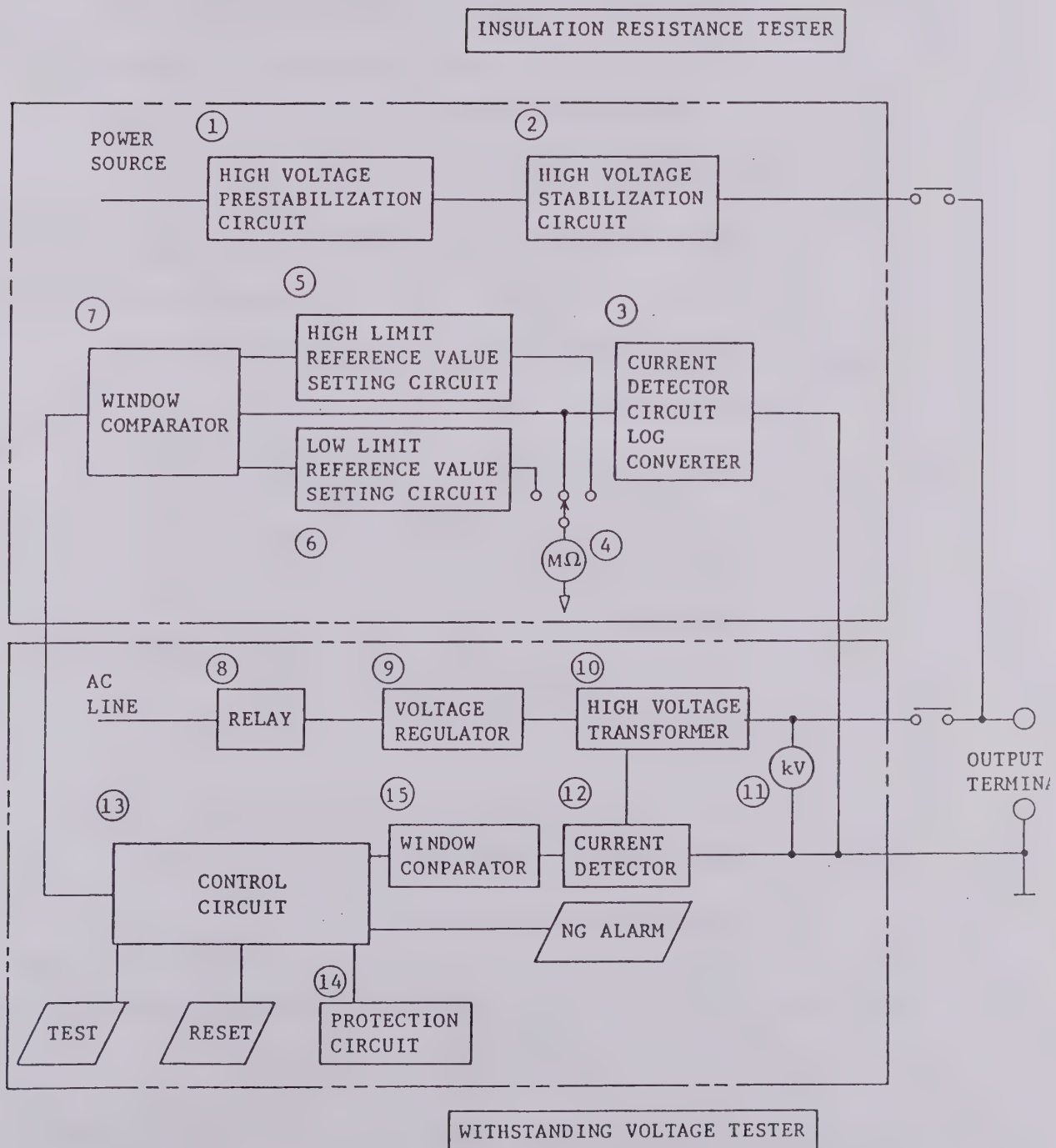


Figure 5.1

5.2 Descriptions of Individual Circuits

(1) High voltage prestabilization circuit:

In order to obtain the high voltage required for insulation resistance test, this circuit tripple-voltage rectifies the AC input power and roughly prestabilizes the DC output voltage at approximately 1150 V.

(2) High voltage stabilization circuit:

Stabilizes the above DC voltage more finely, in order to be applied as an insulation resistance test volatge to the device under test. The test voltage is a negative voltage of nominal 1000 V or 500 V.

(3) Current detector circuit with log converter:

The current which flows in the device under test varies ranging from less than 1 μA to approximately 1 mA when shorted.
To detect and indicate this wide dynamic range current on the single range scale of the ohmmeter, this circuit has a log converter which converts the detected signal into a logarithmic signal. A highly accurate log converter is used in order to satisfy the specification accuracy.

(4) Ohmmeter:

This meter is driven by the above logarithmic signal to indicate the insulation resistance of the device under test.

(5) High limit reference value setting circuit:

Sets the high limit reference value for GO-NOGO judgement. The value is adjustable with its potentiometer on the front panel.

(6) Low limit reference value setting circuit:

Sets the low limit reference value for GO-NOGO judgement. The value is adjustable with its potentiometer on the front panel.

⑦ Window comparator:

Generates a GOOD signal if the measured value is within the range between high and low limit reference values. If not, generates an NG signal.

⑧ Relay:

On-off controls the power applied to the voltage regulator for withstanding voltage test. A solid-state zero-start type relay circuit is employed to minimize transiential spike voltages caused when the high voltage output is turned on or off.

⑨ Voltage regulator:

A slide transformer is used to control the output voltage.

⑩ High voltage transformer:

Boosts the voltage regulator output with a ratio of 1:25 or 1:50 into a high output voltage of 0 to 2.5 kV or 0 to 5 kV. The rating is 5 kV, 100 mA (500 VA) when the AC line voltage is 100 V.

⑪ Voltmeter:

Indicates the output voltage for withstanding voltage test.

⑫ Current detection circuit:

Consists of a current detecting resistor, a reference voltage generator circuit, and a comparator.

⑬ Control circuit:

Controls overall operations of the Tester. Structured in high-reliability logic circuits with CMOS IC.

⑭ Protective circuits:

Various protective features are incorporated for the safety of test.

⑮ Window comparator:

Generates a GOOD signal only when the leakage current is within the range between the high limit reference value set with the CUTOFF CURRENT switches and the low limit reference value set with the LOWER REFERENCE value control. When the leakage current is not within the above range, the comparator generates an NG judgement.

5.3 Zero-start Switch

If a regular mechanical contact type relay is used for on-off operation of the primary circuit of the high voltage transformer, transiential spike voltages could be produced, thereby applying an unjustifiedly high voltage to the device under test (DUT) and causing a possibility of rejecting an acceptable DUT. The zero-start switch, which employ a solid-state switching circuit, turns on and off the power line at approximately 0 volt level, thereby reducing transiential overshoots.

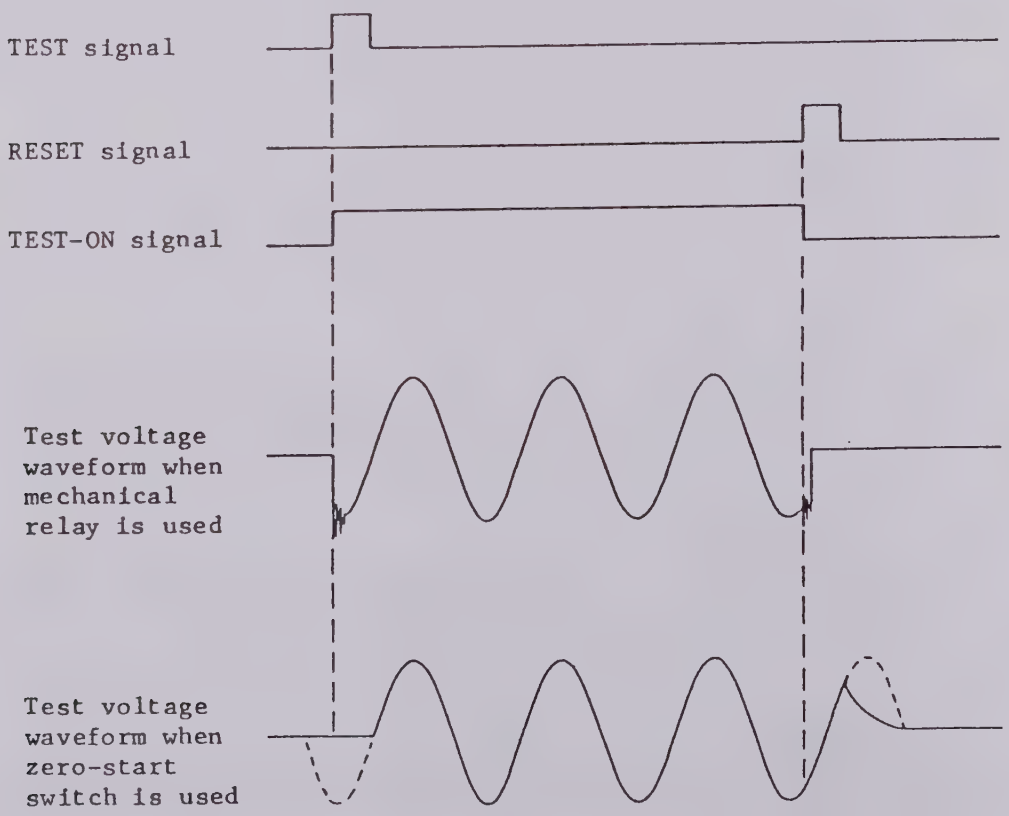

TEST signal
RESET signal
TEST-ON signal
Test voltage waveform when mechanical relay is used
Test voltage waveform when zero-start switch is used

Figure 5.2

However, if the DUT is connected or disconnected under the state that the test voltage is being delivered, spikes are produced at the instant of contacting and the effect of the use of the zero-start switch is lost. It also is dangerous. Be sure to turn on or off the test voltage using the TEST and RESET button after the DUT is securely connected.

5.4 Waiting-time for Judgement in Insulation Resistance Test

When a test voltage is applied to a DUT which has a larger capacitance, a larger charge current will flow at the initial short period and the resistance of the DUT may be indicated lower than the actual value. In order to eliminate such period from the GO-NOGO judgement period, a time delay provision is incorporated. The delay time is set at approximately 0.3 seconds. If the timer is set at a period shorter than 0.3 seconds, the effect of the above provision will be lost and a GOOD judgement may be made erroneously. Be sure to set the timer for a period longer than 0.5 seconds.

6. MAINTENANCE

6.1 Cautions

A hazardously high voltage of a level of 5 kV is generated within this Tester. Never-attempt to repair the Tester for yourself. For such service, contact your Kikusui agent.

This section covers the calibration procedure of the Tester. Be extremely careful not to touch the electrically charged parts.

6.2 Calibration

This section covers the following calibration procedures.

- o Calibration of voltmeter of withstanding voltage tester
- o Calibration of high limit reference (CUTOFF CURRENT) value of leakage current for withstanding voltage test
- o Calibration of low limit reference (LOWER REFERENCE) value of leakage current for withstanding voltage test
- o Calibration of insulation resistance tester
- o Calibration of waiting-time for judgement for insulation resistance test
- o Calibration of GOOD signal generating period

(1) Instruments Required for Calibration

① Voltmeter I

AC voltmeter, 0.5 - 5 kV, 50 - 60 Hz, accuracy 1%.
(Kikusui Model 149-10A or an equivalent)

② Voltmeter II

DC voltmeter, 0.5 - 1.1 kV, input resistance ≧ 1000 MΩ, accuracy 1%. (Kikusui Model 149-10A or an equivalent)

③ Voltmeter III

DC voltmeter, 1.0 - 2.5 V, accuracy 0.1%

④ Load Resistors with Milliammeter

AC Ammeter, 0.5 - 100 mA (50 - 60 Hz) at test voltage 1000 V (800 V) with an accuracy of 1%. (Kikusui Model TOS1200 or equivalents)

⑤ Standard Resistors

To calibrate insulation resistance tester. 1 MΩ - 2000 MΩ, decade type, voltage rating ≧ 1100 V, accuracy 1%.

⑥ Oscilloscope

When ④ "Load Resistors with Milliammeter" are unavailable, a milliammeter and load resistors (ones for points not calibrated may be omitted) may be used instead.

o Milliammeter

AC milliammeter, 0.25 - 100 mA, 50 - 60 Hz, accuracy 1%

o Load Resistors

Voltage rating ≧ 1.1 kV AC, accuracy 5%.
Use the resistance with enough greater wattages than shown in Table 6.1.

Table 6.1

Current [mA]	Load Resistor	
	Resistance [Ω]	Power consumption [W]
*0.25	4M	0.25
0.5	2M	0.5
1	1M	1
2	500k	2
4	250k	4
*5	200k	5
8	125k	8
10	100k	10
*50	20k	50
100	10k	100

*: The values marked with the asterisks are for calibration of low limit reference (LOWER REFERENCE) values of leakage current.

(2) Preparation for Calibration

① Before turning on the POWER switch, adjust the mechanical zero position of indicating meters.

② Turn on the POWER switch and allow a stabilization period of 15 minutes or more.

③ For layouts of components on PCB's, see Figures 6.5 and 6.6.

(3) Calibration of Output Voltmeter of Withstanding Voltage Tester

① Set the panel switches as follows:

- o FUNCTION switch: MANUAL W
- o RANGE 2.5kV/5kV switch: 2.5kV
- o TIMER ON/OFF switch: OFF

- o LOWER ON/OFF switch: OFF
- o TEST VOLTAGE dial: Fully counterclockwise ("0" position)

(2) Connect voltmeter I to the output terminal. Set the Tester to the TEST ON state and adjust the output voltage so that the voltmeter reads 2.5 kV

(3) Adjust RV103 so that the Tester voltmeter pointer deflects to the center of the 2.5kV scale.

(4) Reduce the output voltage to zero. Change the RANGE 2.5kV/5kV switch to the 5kV range.

(5) Calibrate the 5kV range with RV104 in a similar manner as the 2.5kV range is calibrated with RV103. After the calibration is over, turn the TEST VOLTAGE dial to the fully counterclockwise position ("0" position) and press the RESET button.

(6) Acquire data of the required test points.

(4) Calibration of High Limit (CUTOFF CURRENT) Value of Leakage Current for Withstanding Voltage Test

Measure the voltage of TP110 with reference to TP112, with voltmeter III. Adjust RV101 so that the voltmeter reads 2.318 V ±0.2%.

(5) Check of High Limit (CUTOFF CURRENT) Value of Leakage Current for Withstanding Voltage Test

(1) Only with the calibration of Item (4) above, the high limit reference value satisfies the specified judging accuracy. If it does not, the Tester is malfunctioning.

(2) Set the panel switches of the Tester as mentioned in Item (3) (1). Select the required high limit reference value of leakage current with the CUTOFF CURRENT switches.

③ Prepare a test setup using load resistors with milliammeter (Kikusui Model TOS1200) or using load resistors appropriate for CUTOFF CURRENT switches and an AC milliammeter, as shown in Figure 6.1 or 6.2. For the resistances of the load resistors, see Table 6.1.

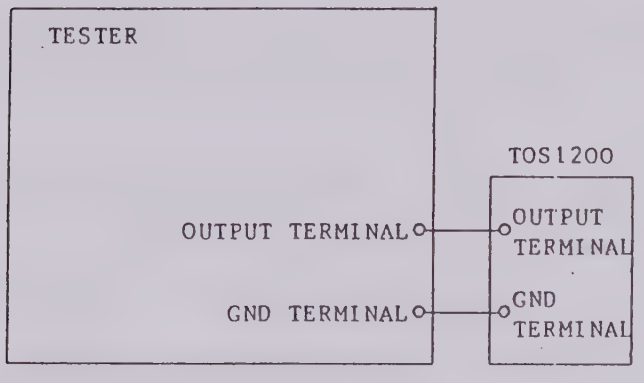


Figure 6.1

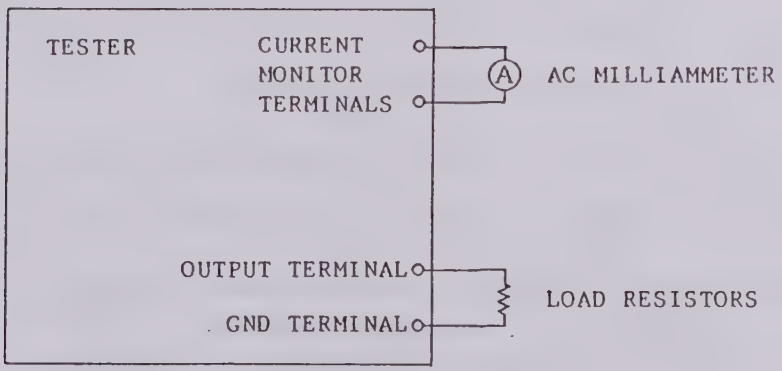


Figure 6.2

④ Set the Tester to the TEST ON state and gradually increase the output voltage. The Tester will generate an NG alarm at approximately 1 kV. Slightly turn counterclockwise the TEST VOLTAGE dial and set again the Tester to the TEST ON state.

⑤ Increasing the output voltage very slowly, read the value of the current immediately before an NG alarm is generated and the output is cutoff.

⑥ Repeat the procedure of ③ - ⑤ for indicidual high limit reference value (CUTOFF CURRENT) as required.

(6) Calibration of Low Limit (LOWER REFERENCE) Value of Leakage Current for Withstanding Voltage Test

① Turn the LOWER REFERENCE control potentiometer to the fully clockwise position.

② Measure the voltage of TP111 with reference to TP112, with voltmeter III. Adjust RV102 so that the voltmeter reads 1.092 V ±0.2%.

(7) Check of Low Limit Reference (LOWER REFERENCE) Value of Leakage Current for Withstanding Voltage Test.

① Only with the calibration of Item (6) above, the low limit reference value satisfies the specified judging accuracy. If it does not, the Tester is malfunctioning.

② Set the panel switches of the Tester as mentioned in Item (3) ①. Select the required low limit reference value with the CUTOFF CURRENT switches.

③ Turn the LOWER REFERENCE potentiometer fully clockwise. As you do this, the low limit reference value is set at one-half of the high limit reference value set in Step ② above.

④ Prepare a test setup using resistors with milliammeter (Kikusui Model TOS1200) or using load resistors appropriate for low limit reference value and an AC milliammeter, as shown in Figure 6.1 or 6.2. For the resistances of the load resistors, see Table 6.1.

⑤ Set the Tester to the TEST ON state and gradually increase the output voltage to a point (approximately 1.1 kV) where the current becomes greater than the set low limit reference value by approximately +10%. (Keep the LOWER ON/OFF switch in the OFF state.)

⑥ Turn the LOWER ON/OFF switch to the ON state.

⑦ Gradually decrease the output voltage. The Tester will generate an NG alarm at appropriately 1 kV of output voltage. Slightly turn clockwise the TEST VOLTAGE dial. Set the Tester again to the TEST ON state.

⑧ Decreasing the output voltage very slowly, read the value immediately before an NG alarm is generated and the output is cutoff.

⑨ Repeat the procedure of ④ - ⑧ for individual leakage current values as required.

(8) Calibration of Insulation Resistance Tester

① Calibration of output voltage

(a) Set the panel switches of the Tester as follows:

- o FUNCTION: MANUAL I
- o I TEST VOLTAGE 500V/1000V: 1000V
- o TIMER ON/OFF: OFF
- o JUDGE ON/OFF: OFF

(b) Connect voltmeter II to the output terminals. Set the Tester to the TEST ON state. Adjust RV203 so that voltmeter II reads -1025 V. After the adjustment is over, press the RESET button.

(c) Change the I TEST VOLTAGE 500V/1000V switches to 500V.

(d) Adjust RV204 so that voltmeter II reads -513 V.

② The Tester has two test voltage scale ranges. Calibrate it for the one which is used more frequentry in your tests. When one range is calibrated, the other range also is calibrated automatically.

The resistances values enclosed in the parentheses in Steps ⑤ and ⑥ below are for the 500 V range.

③ Set the panel switches of the Tester as in the case of Step ① above.

④ Without connecting anything to the output terminals, set the Tester to the TEST ON state. Adjust RV205 (∞ ADJ) so that the meter indicates the "∞" position of the scale. After the adjustment is over, press the RESET button.

⑤ Connect a standard resistor 2 MΩ (1 MΩ) to the output terminals. Set the Tester to the TEST ON state. Adjust the ZERO ADJ on the front panel so that the meter reads 2 MΩ (1 MΩ). After the adjustment is over, press the RESET button.

⑥ Replace the resistor of the output terminal with a resistor of 100 MΩ (50 MΩ). Set the Tester to the TEST ON state. Adjust RV206 so that the meter reads 100 MΩ (50 MΩ).

⑦ Repeat the procedure of ⑤ and ⑥ for several times, and then repeat the procedure of ④.

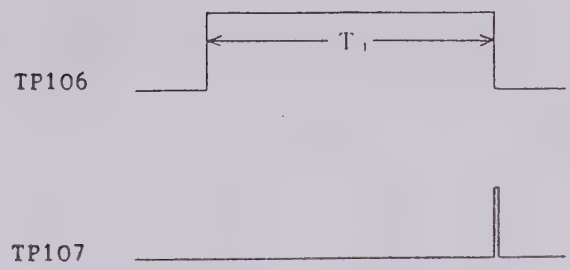
⑧ Short the output terminals. Set the Tester to the TEST ON state. Adjust RV202 so that the meter indicates the "0" scale position.

(9) Calibration of Waiting-time for Judgement for Insulation Resistance Test

① Set the panel switches as follows:

- o FUNCTION: MANUAL I
- o TIMER ON/OFF: OFF
- o JUDGE ON/OFF: ON

② Without connecting anything to the output terminals, set the Tester to the TEST ON state. When doing this, measure the time interval (T1) at TP106 and adjust RV106 so that the time interval becomes 0.3 sec.



(T1 ≒ 0.29 - 0.92 sec)

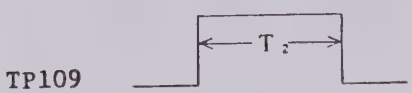
Figure 6.3

(10) Calibration of GOOD Signal Generating Period

1 Set the panel switches as follows:

- o FUNCTION: MANUAL I
- o TIMER ON/OFF: ON
- o JUDGE ON/OFF: OFF
- o I TIMER: ≧ 1 sec

2 Without connecting anything to the output terminal, set the Tester to the TEST ON state. When doing this, measure the time interval (T2) at TP109 and adjust RV107 so that the time interval becomes 50 msec.



(T2 ≒ 30 - 500 msec)

Figure 6.4

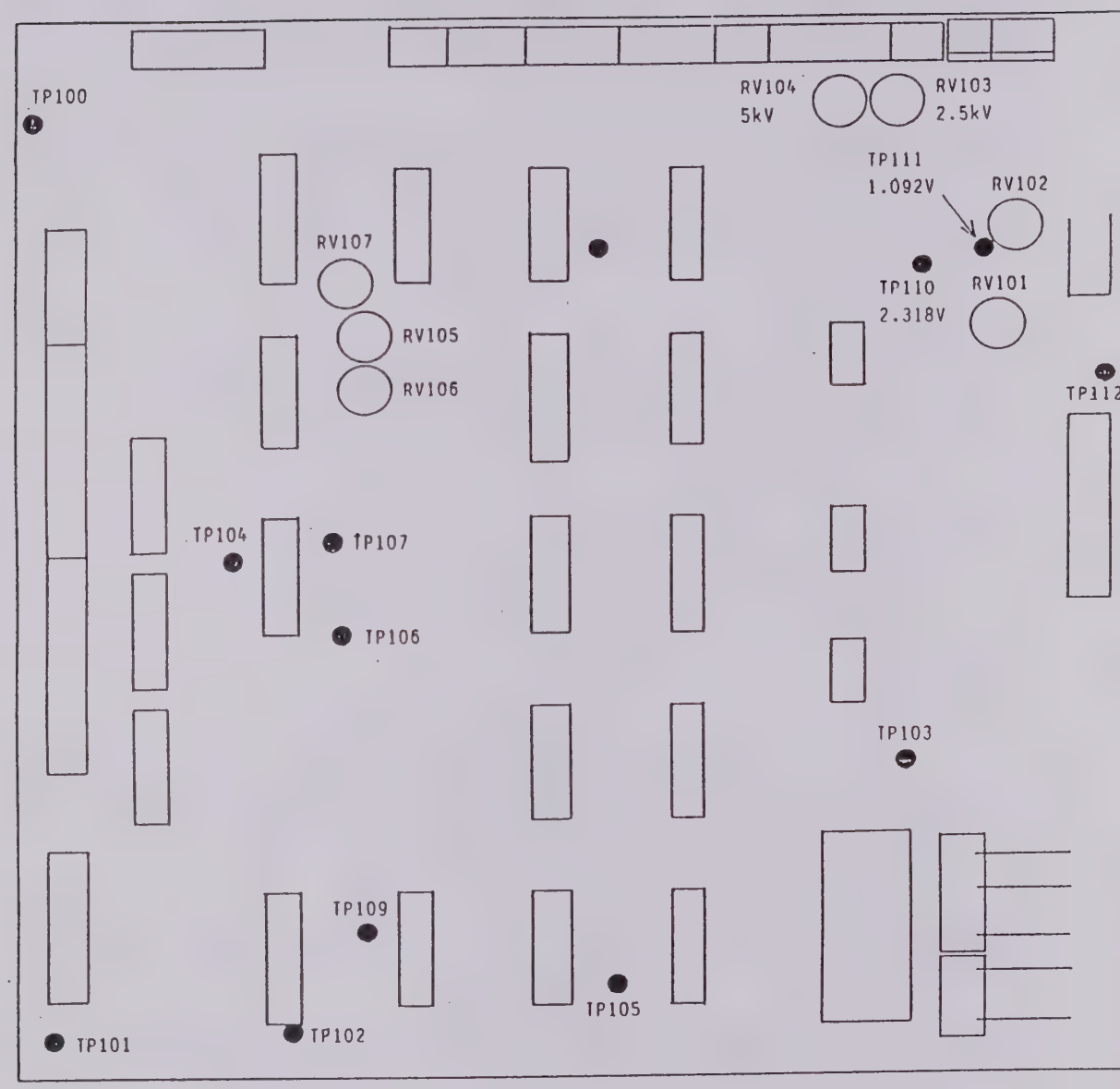


Figure 6.5 Layout of Components on PCB A1

This PCB is located at a left-hand position inside of the Tester.

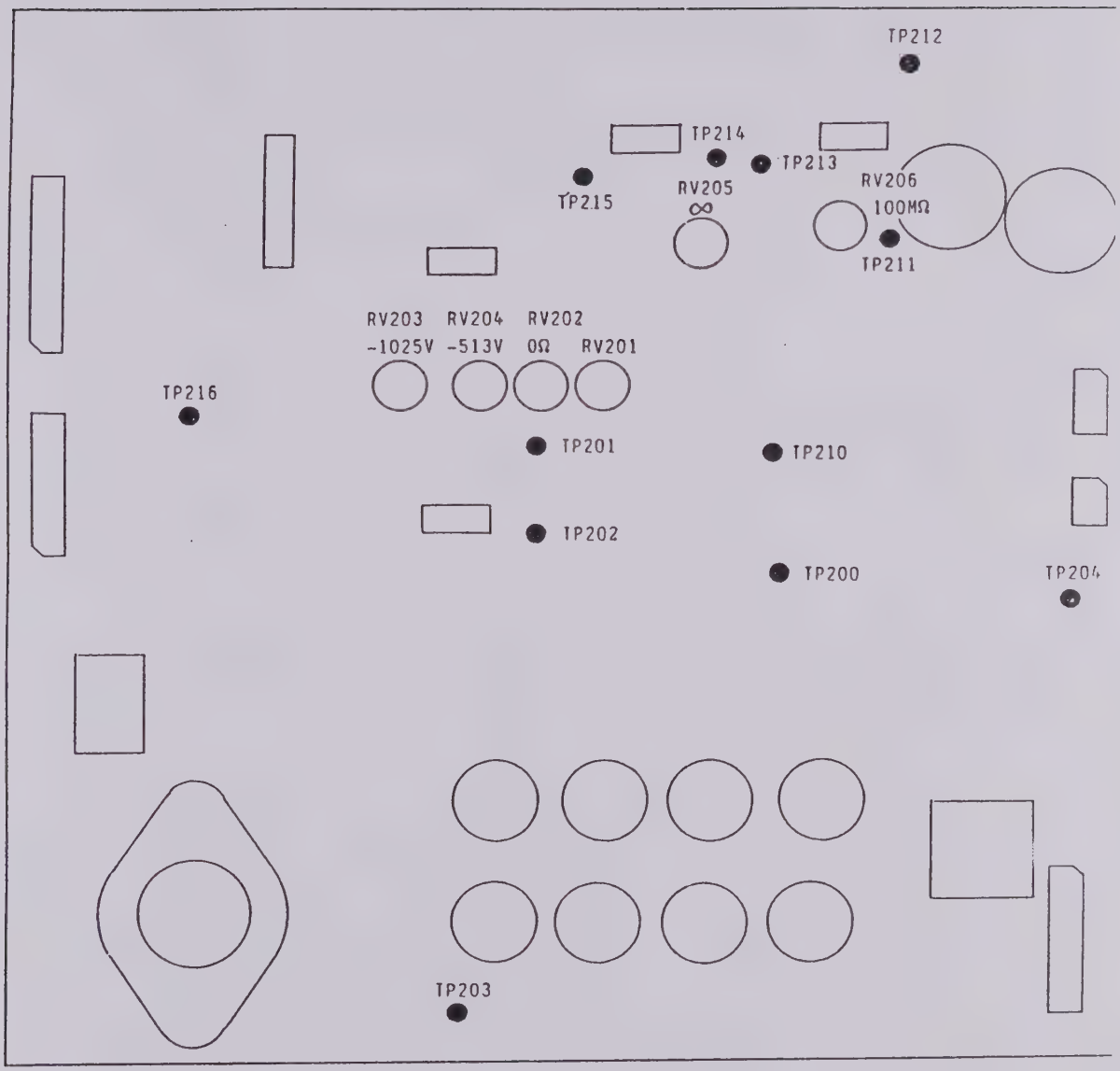


Figure 6.6 Layout of Components on PCB A2

This PCB is located at a right-hand position inside of the Tester.

7. OPTIONS

This section covers devices which are available as optional items for the Tester.

7.1 Model 913A or 914A Remote Control Box

(1) For remote control of TEST and RESET operation

(2) Functions

(a) OPERATE switch

The TEST button is enabled only when the OPERATE switch is ON. When the OPERATE switch is OFF, the TEST button is disabled.

(b) TEST/RESET buttons

The functions of the TEST/RESET buttons are identical with those of the corresponding buttons on the front panel of the Tester. (Special test mode: NG ALARM OFF)

(3) While the 913A has one TEST button, the 914A has two TEST buttons. With the 914A, test starts only when both TEST buttons are pressed at the same time.

(4) Overall dimensions

913A: 150 W, 70 H, 40 D mm
(5.91 W, 2.76 H, 1.57 D in.)

914A: 280 W, 70 H, 40 D mm
(11.02 W, 2.76 H, 1.57 D in.)

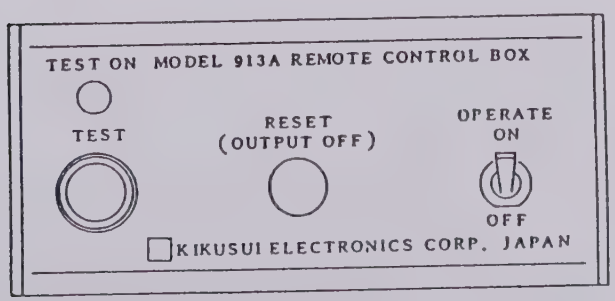


Figure 7.1 Front Panel of 913A Remote Control Box

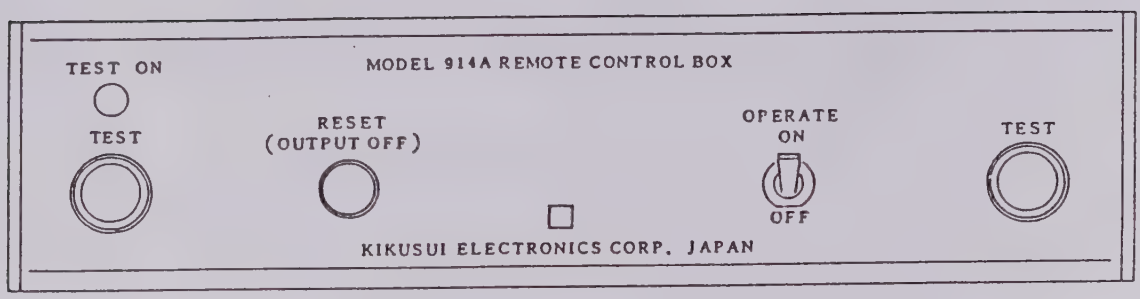


Figure 7.2 Front Panel of 914A Remote Control Box

7.2 Model HTP-1.5A or HTP-3A High Voltage Test Probe

The High Voltage Test Probes are designed for high operation safety, yet maintaining good operability. The test switch can be pressed only when the grip is squeezed, thereby preventing inadvertent turning on of the test voltage. When the test switch is released, the test voltage is cut off unconditionally.

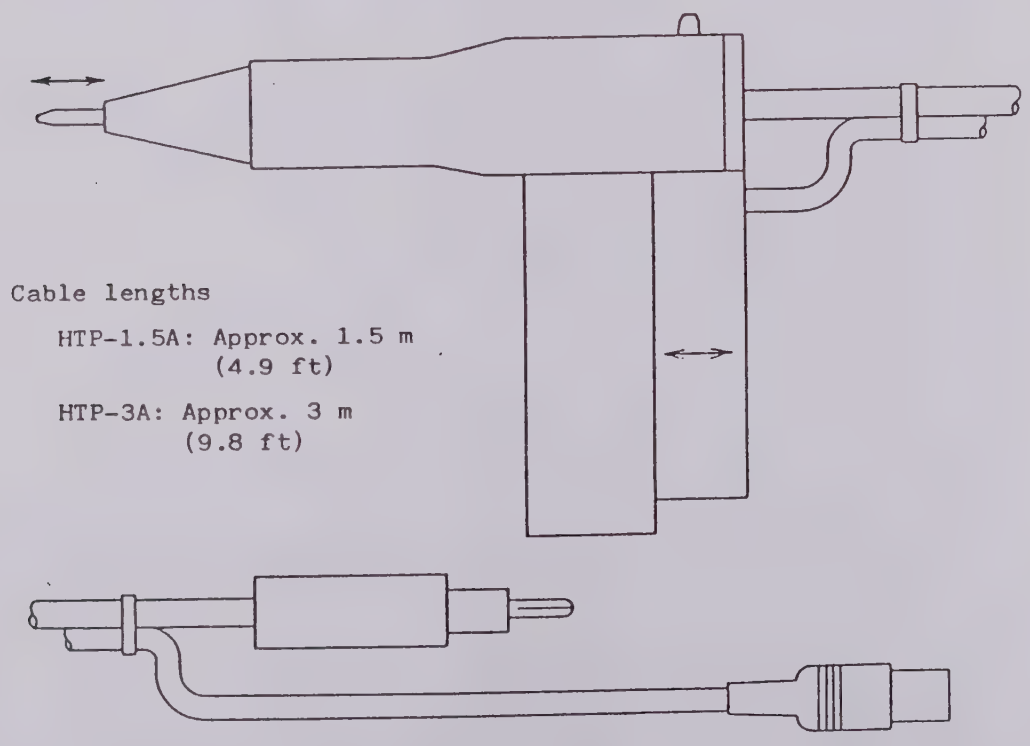


Figure 7.3 High Voltage Test Probes

Notes: 1. The maximum working voltage of the probes is 5 kV. Never attempt to use the probes for voltages higher than 5 kV.

2. When making tests using these probes for UL Standards, employ the "NG ALARM Function" of the Tester (see Section 4.3.7).

7.3 Model HTL-3W High Voltage Test Leadwires

These leadwires are used for application of a high test voltage. They are 3 meters long.

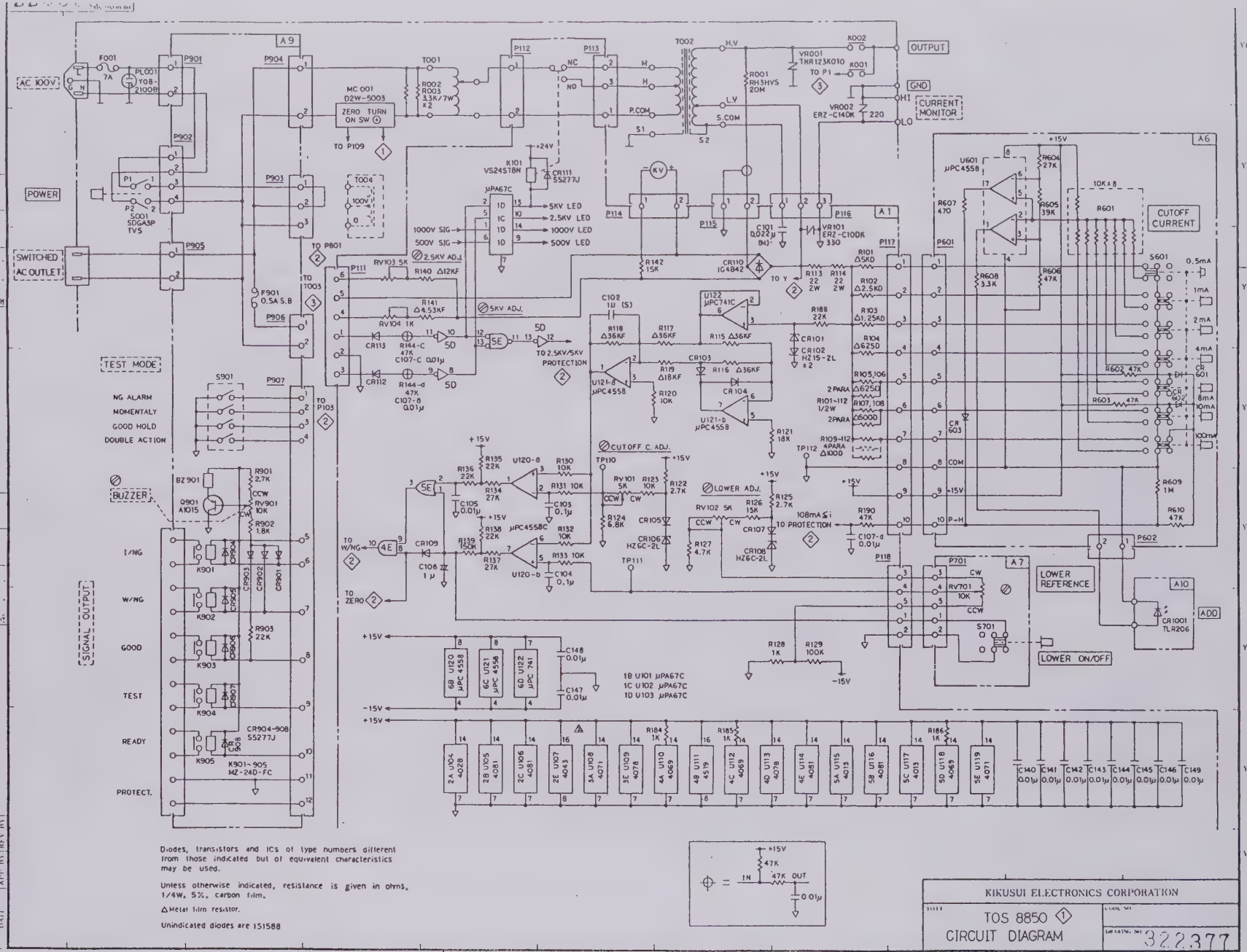
Note: The maximum working voltage of the leadwires is 5 kV. Never attempt to use the leadwires for voltages higher than 5 kV.

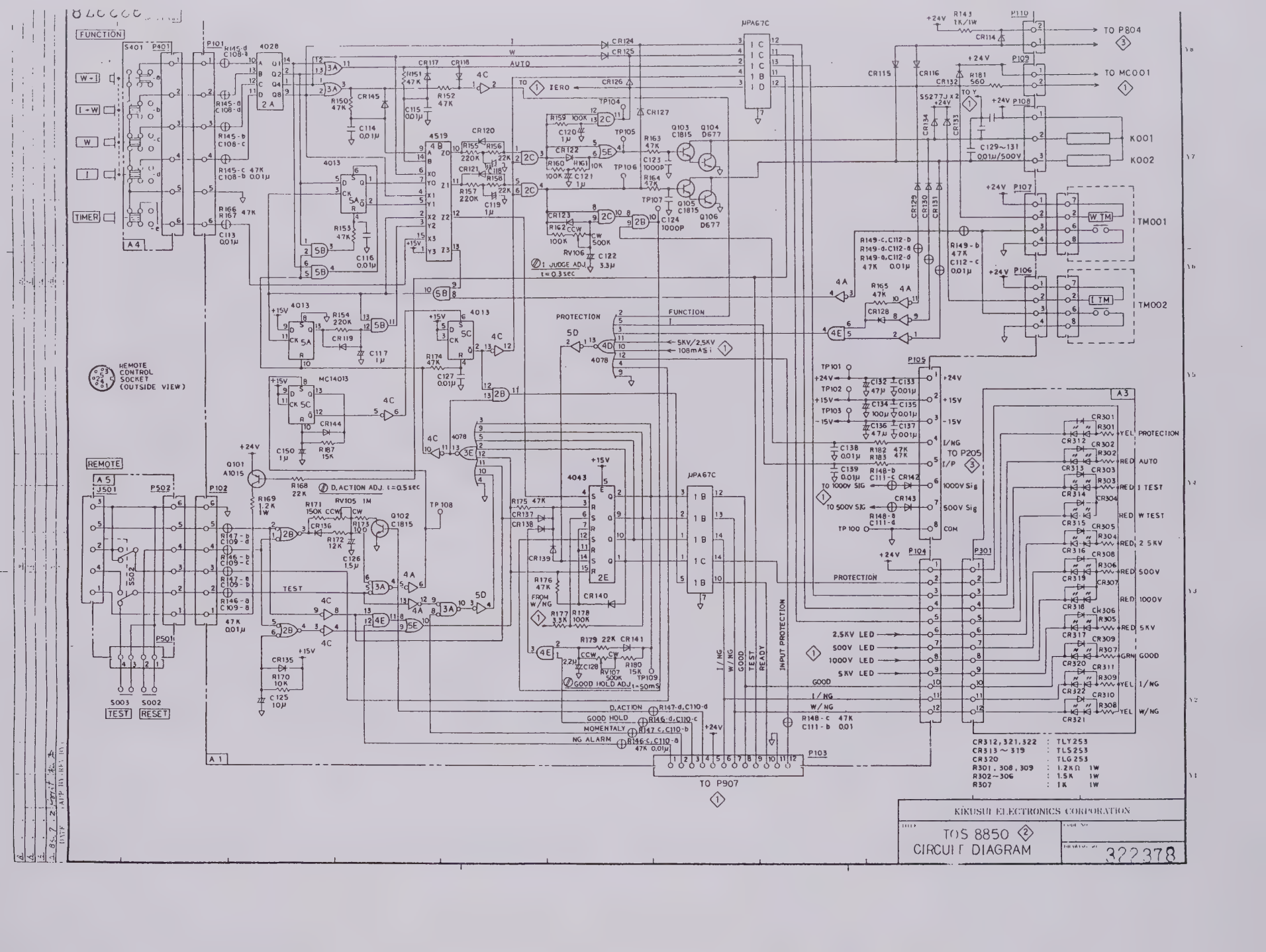
7.4 Model 9202 Warning Light

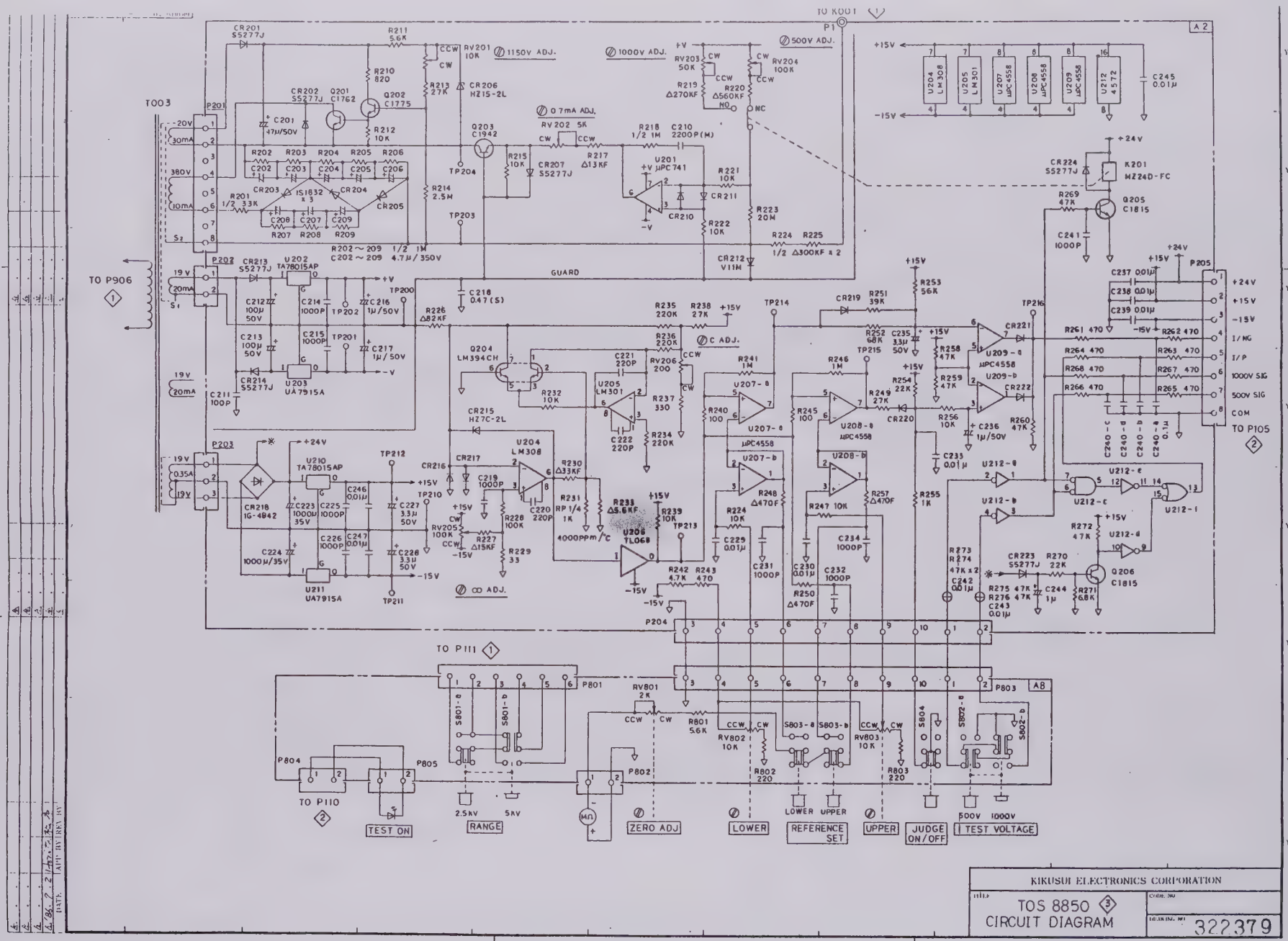
This unit indicates that the Tester is in the TEST ON state. The unit is driven by the TEST ON signal (contact signal) of the Tester.

7.5 Model 9203 Buzzer Unit

This buzzer unit is used to annunciate the NG state. It may be used when the loudness of annunciation only with the buzzer built in the Tester is insufficient. The 9203 is driven by the NG alarm (contact signal) of the Tester.


AC 100V
POWER
SWITCHED AC OUTLET
SIGNAL OUTPUT
TEST MODE
NG ALARM
MOMENTALY
GOOD HOLD
DOUBLE ACTION
BUZZER
I/NG
W/NG
GOOD
TEST
READY
PROTECT.
OUTPUT
GND
CURRENT MONITOR
CUTOFF CURRENT
LOWER REFERENCE
LOWER ON/OFF
5KV LED
2.5KV LED
1000V LED
500V LED
1000V SIG
500V SIG
2.5KV ADJ
5KV ADJ
CUTOFF C. ADJ.
LOWER ADJ.
TO PROTECTION
TO 2.5KV/5KV PROTECTION
TO W/NG
TO ZERO
18 U101 μPA67C
1C U102 μPA67C
1D U103 μPA67C
Diodes, transistors and ICs of type numbers different from those indicated but of equivalent characteristics may be used.
Unless otherwise indicated, resistance is given in ohms, 1/4W, 5%, carbon film.
△Metal film resistor.
Unindicated diodes are 1S1588
KIKUSUI ELECTRONICS CORPORATION
TOS 8850 ①
CIRCUIT DIAGRAM
322377

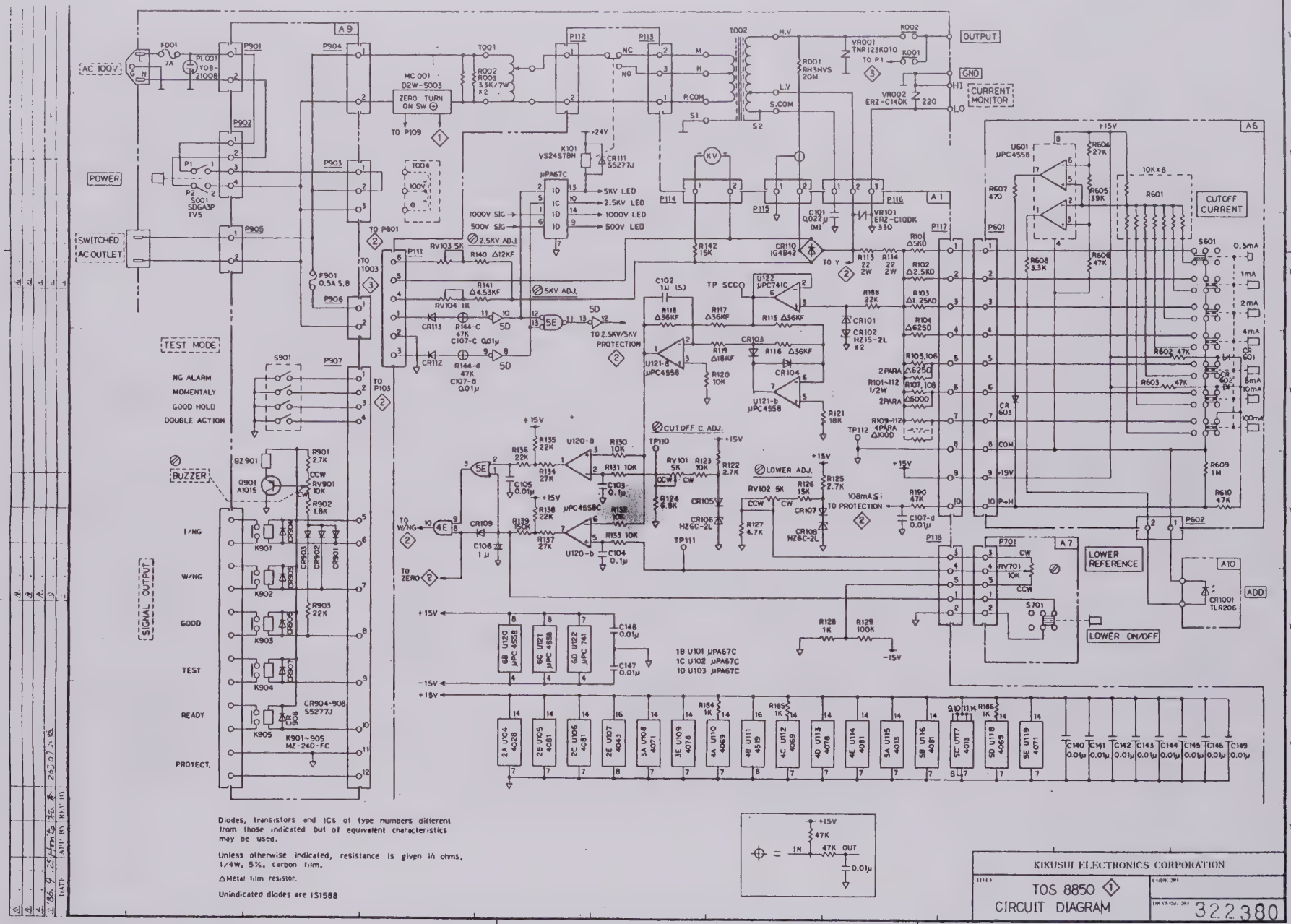

FUNCTION
W→I
I→W
W
I
TIMER
REMOTE
TEST
RESET
AUTO
TO ① IERO
TO P804
TO MC001
K001
K002
TM001
TM002
W TM
I TM
REMOTE CONTROL SOCKET (OUTSIDE VIEW)
PROTECTION
5KV/2.5KV
10mA≦i
TO P205 I/P
1000V Sig
500V Sig
COM
2.5KV LED
500V LED
1000V LED
5KV LED
GOOD
I/NG
W/NG
INPUT PROTECTION
TO P907
D.ACTION
GOOD HOLD
MOMENTALY
NG ALARM
CR312,321,322 : TLY253
CR313～319 : TLS253
CR320 : TLG253
R301, 308, 309 : 1.2kΩ 1W
R302～306 : 1.5k 1W
R307 : 1k 1W
KIKUSUI ELECTRONICS CORPORATION
TOS 8850 ②
CIRCUIT DIAGRAM
322378



KIKUSUI ELECTRONICS CORPORATION

TOS 8850 ③
CIRCUIT DIAGRAM

DRAWING NO. 322379

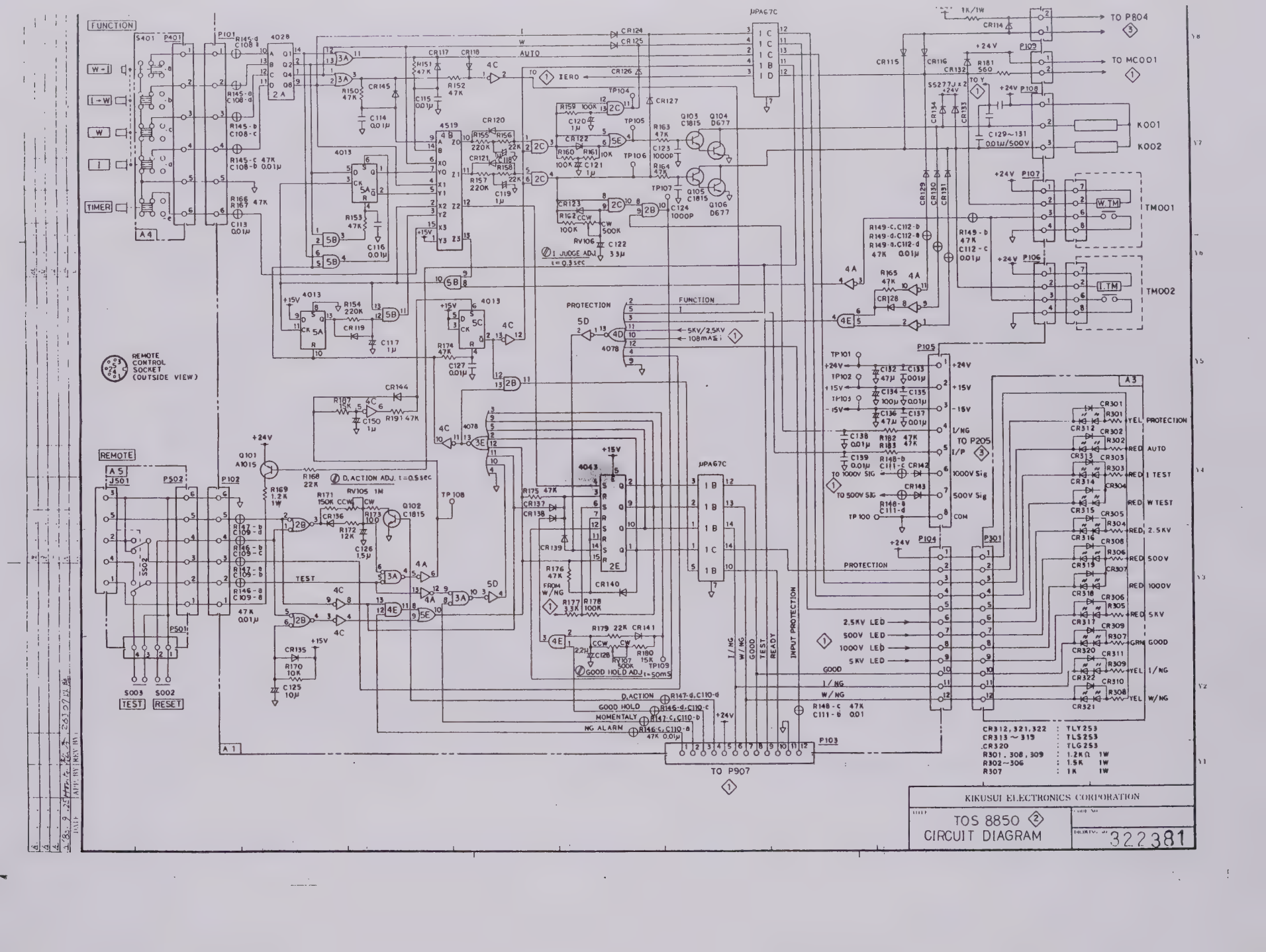


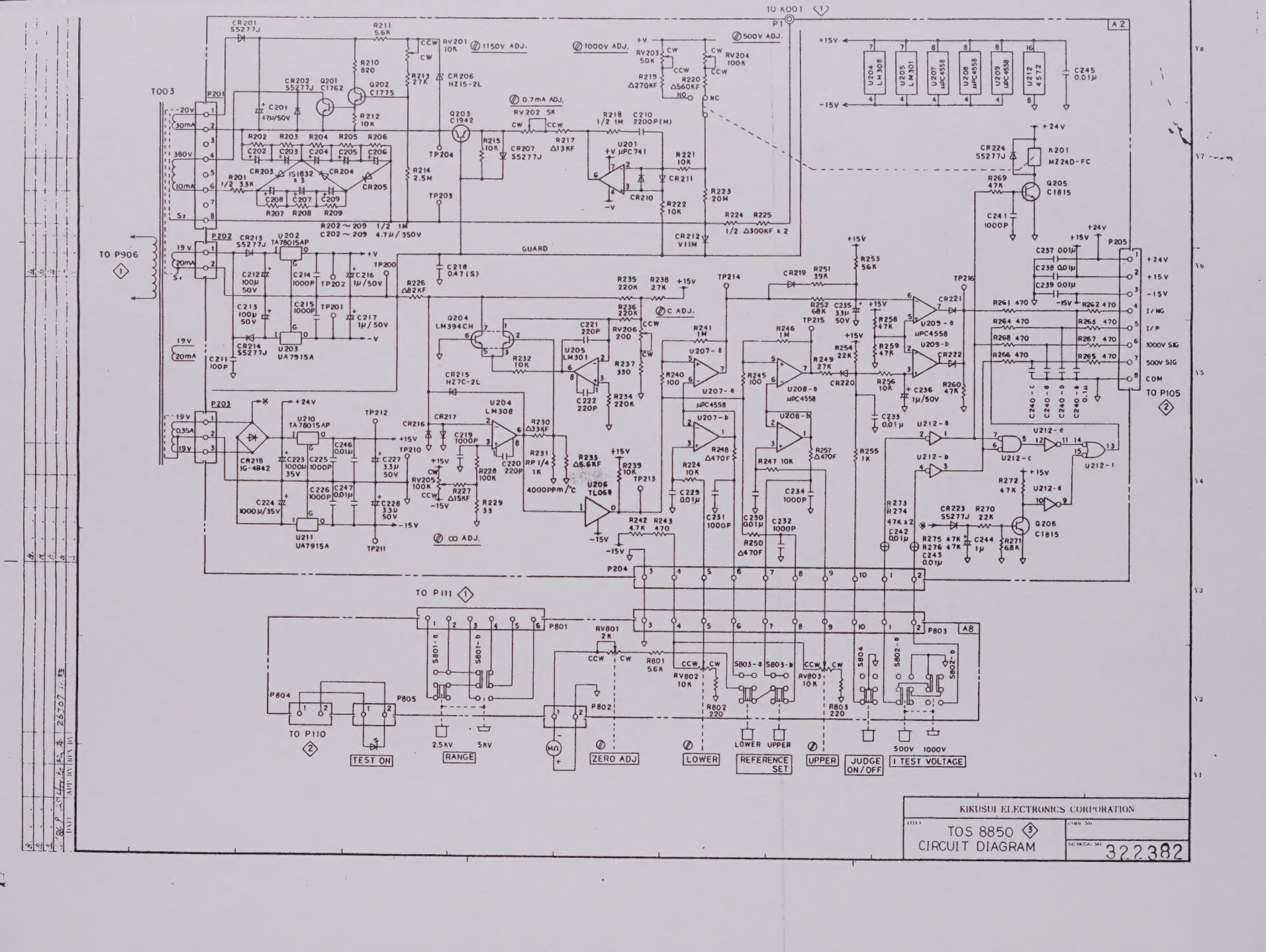
Diodes, transistors and ICs of type numbers different from those indicated but of equivalent characteristics may be used.

Unless otherwise indicated, resistance is given in ohms, 1/4W, 5%, carbon film.

△Metal film resistor.

Unindicated diodes are 1S1588


FUNCTION
REMOTE
REMOTE CONTROL SOCKET (OUTSIDE VIEW)
TIMER
TEST
RESET
PROTECTION
INPUT PROTECTION
TO P907
TO P804
TO MC001
TO P205
K001
K002
TM001
TM002
W.TM
I.TM
KIKUSUI ELECTRONICS CORPORATION
TOS 8850 ②
CIRCUIT DIAGRAM
322381


TO K001
P1
A2
TO T003
TO P906
TO P105
TO P111
TO P110
P201
P202
P203
P204
P205
P801
P802
P803
P804
P805
A8
TP200
TP201
TP202
TP203
TP204
TP205
TP206
TP210
TP211
TP212
TP213
TP214
TP215
TP216
GUARD
TEST ON
RANGE
ZERO ADJ
LOWER
REFERENCE SET
UPPER
JUDGE ON/OFF
TEST VOLTAGE
KIKUSUI ELECTRONICS CORPORATION
TOS 8850
CIRCUIT DIAGRAM
322382

93312